DOMINION OF CANADA

REPORT OF THE DEPARTMENT
OF
MINES AND RESOURCES
FOR THE
FISCAL YEAR ENDED MARCH 31, 1947

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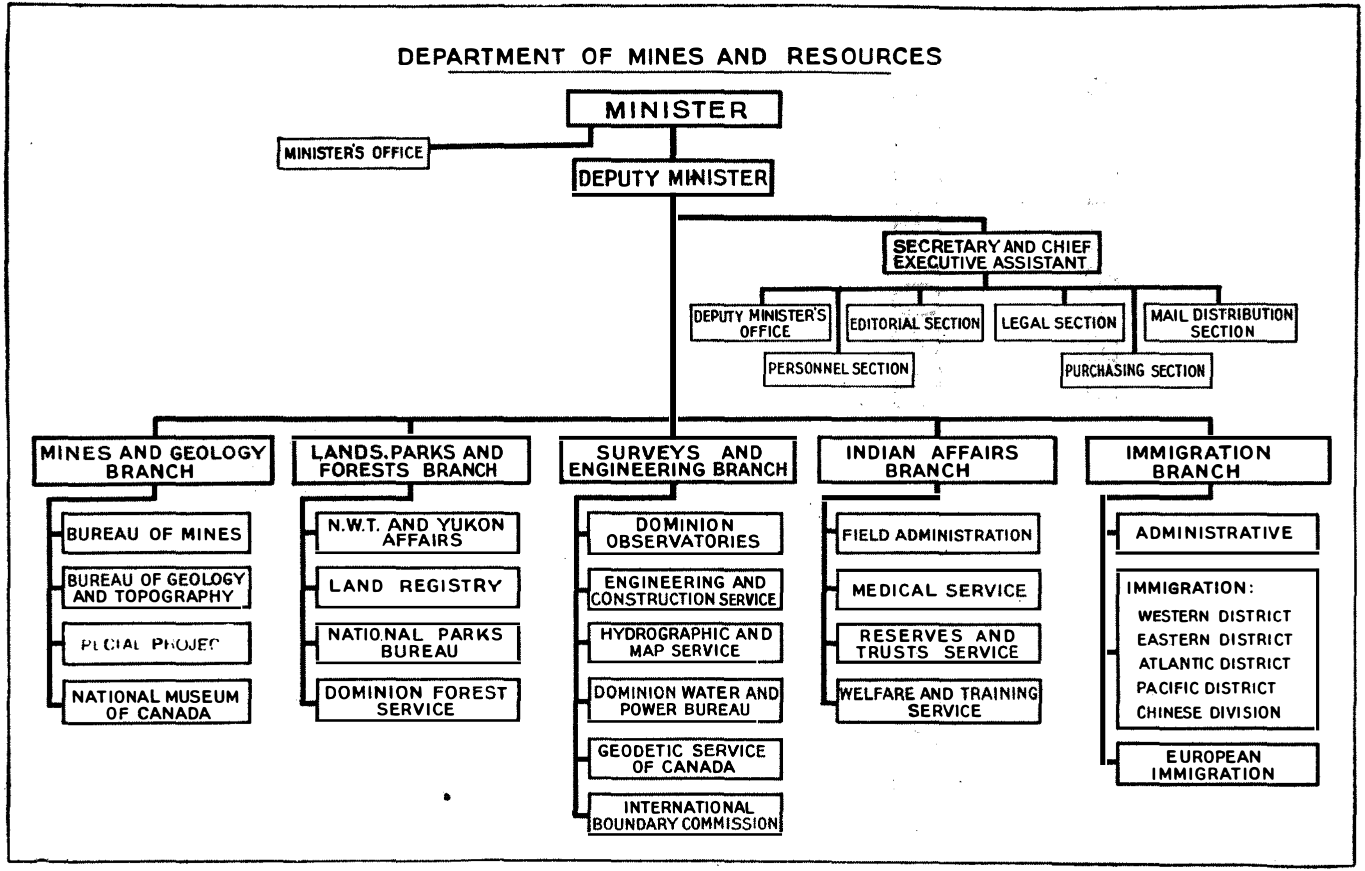

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To His Excellency Field Marshal the Right Honourable Viscount Alexander of Tunis, K.G., G.C.B., G.C.M.G., C.S.I., D.S.O., M.C., Governor General and Commander-in-Chief of Canada.

MAY IT PLEASE YOUR EXCELLENCY:

The undersigned has the honour to lay before Your Excellency the Annual Report of the Department of Mines and Resources for the fiscal year ended March 31, 1947.

Respectfully submitted,

J. ALLISON GLEN,

Minister of Mines and Resources.

The Honourable J. Allison Glen,
Minister of Mines and Resources,
Ottawa.

SIR:

I have the honour to submit the Eleventh Annual Report of the Department of Mines and Resources, which covers the fiscal year ended March 31, 1947.

Your obedient servant,
H. L. KEENLEYSIDE,
Deputy Minister.

LANDS, PARKS AND FORESTS BRANCH

R. A. GIBSON, DIRECTOR

During the past year, Government expenditures in the Northwest Territories provided substantial evidence of faith in the potentialities of the mining areas of the Mackenzie District, particularly in the field which centres on Yellowknife. Some of the more important projects on which outlays were made included the Grimshaw-Great Slave Lake road; the hydro-electric power development on Snare River and the transmission line to Yellowknife; the improvement of the Yellowknife airport which now provides facilities for the larger type of transport and passenger aircraft; the improvement of roads, the installation of water and sewer services and assistance in the construction of a modern public school and Red Cross hospital in Yellowknife, and the construction of adequate administration buildings at Yellowknife, Fort Smith, and elsewhere.

Although the number of new claims staked in the Yellowknife mining area decreased, more intensive prospecting and actual development were undertaken. Moreover, a great deal of interesting new territory was brought into the mining picture. The Eldorado mine continued to produce pitchblende concentrates on a satisfactory scale. With the announcement of the Government policy for the mining of radio-active substances, more development in this field may be anticipated. Imperial Oil Limited continued the production of crude petroleum and oil products at Norman Wells, but the output is designed to meet the requirements of the local market.

For those who are dependent on hunting and trapping for a livelihood, the most significant improvement was the organization of a forest protection and game conservation service. Wood is utilized for a great variety of purposes in the Northwest Territories, and as forests mature more slowly in northern latitudes they must be conserved. The native population and a great many of the half-breeds are totally dependent upon wildlife for sustenance. Their only revenue is derived from the pelts that they trade for necessities. Statistics indicate that the annual fur catch has been declining, and the need for a long range wildlife management policy is apparent.

Steps are under way to improve and extend the system of education in the Northwest Territories. Plans include the use of the most modern methods of teaching, and the extension of the program to include adults. Concurrently, with the improvement of education, increased attention is being devoted to the welfare of the local population. In this connection, the benefits derived from family allowances are becoming apparent.

The interdepartmental Committee on Agriculture in northwestern Canada has continued its studies, and the reports issued by the Experimental Farms Service of the Department of Agriculture are very encouraging. It has been possible to assign more scientists to the study of all resources, and steady progress is being made in the mapping of the Northwest Territories.

The past year marked the retirement from the post of Deputy Minister of Mines and Resources and Commissioner of the Northwest Territories of Dr. Charles Camsell, whose name has been synonomous with northern development for so many years. He has been succeeded by Dr. Hugh L. Keenleyside, who is well-known for his interest in northern Canada. Two other veterans of the Northwest Territories Administration, Austin L. Cumming and Kenneth R. Daly, retired from the Northwest Territories Council and were replaced by A/C Harold F. Godwin, of the Royal Canadian Air Force, and Louis de la C. Audette, Legal Adviser, Department of External Affairs. John G. McNiven, manager of Negus Mines Limited, Yellowknife, also was appointed to the Northwest Territories Council. His appointment was the first made from outside the public service to the Council as at present constituted, and provides a member who is resident in the Territories.

Administration in the Yukon was marked by the retirement of Controller G. A. Jeckell, who served the Territory long and well. John E. Gibben, Stipendiary Magistrate, has been acting in his stead. The re-opening of the former Treadwell Yukon property in the Mayo District by the Keno Hill Mining Company Limited, and increased exploration and development of mineral properties at many other places in the Territory, have stimulated interest in the natural resources.

A desire on the part of a great many people, particularly from the United States, to travel to the Yukon and Alaska by way of the Alaska Highway has been apparent, but, as there was insufficient overnight accommodation available, it was necessary to continue a permit system. Permits to travel over the highway were granted to those having business in the region, provided their vehicles were roadworthy and were properly equipped and supplied for the journey. It is the feeling of the administration that, for the present, tourists should be encouraged to travel to places where better facilities are available.

Attendance in the National Parks has shown a sharp increase and the totals should soon exceed pre-war figures. For many years it was possible to do little more than actual maintenance of these outstanding national properties, but during the past year additional funds have been provided for the replacement of worn-out and obsolete equipment, so that the standard of maintenance has been improved. Unfortunately it was impossible to obtain delivery of all equipment required. Satisfactory labour was increasingly difficult to secure. Competing employers were able to offer rewards which exceeded the prevailing rates upon which Government wages are based. The aims of the administration have been the improvement and extension of facilities for comfortable travel and accommodation at fair rates. Concessionaires were unable to obtain building materials, as these were required to alleviate the current housing situation. In the circumstances, the public camp-grounds in the parks were used by travellers to a greater extent. Camp-grounds are being made more convenient and attractive and all are equipped with camp-stoves, tables and fuel. In some of the largest, electricity, running water, and community refrigerators with individual lockers have been provided. Concessionaires operate on the larger camp-grounds and cater to the needs of travellers.

Looking to the future, a broad program of National Park extension and development is envisaged. One of the chief needs of the National Parks system is additional accommodation for travellers of limited means. If private capital is unable to make the required investments, it may be necessary for the Government to erect accommodation and lease it to concessionaires, preferably returned service personnel who are qualified to provide the services required. A considerable extension of the wildlife conservation policy, including maintenance of a proper balance of wildlife and the replenishment of game fish, is desirable. The improvement and extension of communication systems in the parks should be continued. Consideration should be given to the recruitment and training of personnel for the park warden service. The principal highways leading to the parks, and the main avenues of travel in the parks, require improvement by widening, hard-surfacing, and the provision of new bridges where necessary.

Municipal services might be extended and improved where there is a permanent resident population. Adequately trained personnel, especially those required for technical positions, should be appointed. To make the National

Parks system more truly representative, additional National Park areas of suitable size and character, located near the chief centres of population, should be established.

World War II had a very serious effect on the forest resources of the nation, and the work of the Dominion Forest Service is being reorganized to an appreciable extent to meet the changing need for leadership in the post-war development field.

Key personnel who were engaged in war activities have returned to duty. The staff has been strengthened by the addition of valuable, trained personnel. It has been possible to acquire some much needed equipment. Larger appropriations have been made available. Silvicultural research has been continued and expanded on the five forest experiment stations. Additional demonstration work and field surveys have been undertaken. Important programs of research are being carried on in the three forest products laboratories. In planning the schedule of scientific work to be carried on at the laboratories and field station of the Service, the needs of provincial forest services, forest industries, and other departments and organizations interested in research are recognized. The results of investigations are made available to all interested agencies.

During the past year substantial progress has been made in gathering information on the rate at which Canada's forests are reproducing, in the development of methods of preparation of a national forest inventory, in manufacturing techniques for wood products, and in the curtailment of forest waste.

From the representations that are being received, it is evident that the Dominion is expected to provide vigorous leadership in the development of a national forest policy, with the idea of ensuring maximum yields of most desirable wood products in perpetuity, and that, concurrently, watersheds may be protected, wildlife conserved, and healthy recreation afforded to all.

BUREAU OF NORTHWEST TERRITORIES AND YUKON AFFAIRS

NORTHWEST TERRITORIES

The Northwest Territories comprise that part of the mainland of Canada lying north of the Provinces of Manitoba, Saskatchewan, Alberta, and British Columbia and east of Yukon Territory, the islands in Hudson and James Bays and in Hudson Strait including Ungava Bay, and the vast Arctic Archipelago. The estimated total land and freshwater area of the Northwest Territories is 1,304,903 square miles. According to the 1941 census, the population of the Territories was 12,028, including 2,284 whites, 4,334 Indians, 5,404 Eskimos, and 6 others, chiefly Asiatics. An estimate of the population made in 1947 placed the total at 15,514, including 5,527 whites, 4,334 Indians, 5,651 Eskimos, and 2 others (Asiatics).

The Commissioner of the Northwest Territories in Council has power to make ordinances for the government of the Northwest Territories in relation to such subjects as are designated by the Governor in Council under the authority of the Northwest Territories Act. The seat of government is in Ottawa.

Council

Commissioner	Hugh L. Keenleyside.
Deputy Commissioner	Roy A. Gibson.
Members of Council	Stuart T. Wood, Robert A. Hoey, John G. McNiven, Louis de la C. Audette, Harold B. Godwin.
Secretary	James G. Wright.

Work of Council

Four regular and nine special sessions of Council were held during the year. Assent was given to the following ordinances and amendments: Sanitary Control Ordinance; School Assessment Ordinance; School Ordinance; Local Administrative District Ordinance.

In addition, matters of policy were discussed in connection with the eastern Arctic Patrol; Eskimo affairs; medical services in Eastern Arctic; health and welfare; hospital and medical services; Northwest Game Act and Regulations; game and fur situation; radio service; briquetting of coal at Pond Inlet; assistance to mining companies in the construction of trunk roads and airports; meteorological requirements; public buildings, and appointment of Territorial officers and commissioners.

Dr. Charles Camsell, a member of Council since 1921 and Commissioner since 1936, retired on superannuation on November 15, 1946. He was replaced as Commissioner of the Northwest Territories by Dr. H. L. Keenleyside, effective March 15, 1947. J. G. McNiven was appointed member of the Northwest Territories Council as of February 20, 1947, vice K. R. Daly, who resigned on account of ill health. A/C H. B. Godwin was appointed member of the Northwest Territories Council as of March 31, 1947, to replace A. L. Cumming, who also resigned on account of ill health. L. de la C. Audette was appointed member of the Northwest Territories Council on March 31, 1947.

Aministration

The Lands, Parks and Forests Branch is responsible for the administration of the various acts, ordinances, and regulations pertaining to the Northwest Territories. To facilitate departmental administration, there is a Superintendent for the Eastern Arctic and one for the Mackenzie District. A departmental agent is stationed at Fort Smith, N.W.T., and this officer is also Agent of Dominion Lands, Crown Timber Agent, Mining Recorder, Stipendiary Magistrate, and Marriage Commissioner. The Superintendent of Wood Buffalo National Park is also stationed at Fort Smith, as is the Sheriff of the Northwest Territories. The Mining Recorder, Agent of Dominion Lands, and Crown Timber Agent for the Yellowknife Mining District, which includes what was formerly known as the Great Bear Lake Mining District, is situated at Yellowknife. The Mining Recorder for unorganized districts is located at Ottawa, and Sub-Mining Recorders are also located at Ottawa, Edmonton, Fort Simpson, Fort Norman, Aklavik, Coppermine and Port Radium.

Medical Officers

Under the provisions of Order in Council (P.C. 6495) of October 12, 1945, the control and supervision of that part of the public service administering the medical care and hospitalization of Indians, including Eskimos, together with the staff employed, equipment, and other physical assets used in connection therewith, were transferred from the Department of Mines and Resources to the Department of National Health and Welfare as from November 1, 1945.

Although the medical staff of the Department of Mines and Resources was absorbed by the Department of National Health and Welfare, the Government medical officers in the Territories continued to represent the Department of Mines and Resources in the administration of Public Health and other related ordinances and also in connection with the health of all residents of the Territories other than Indians and Eskimos. All doctors have been appointed coroners and medical health officers under the Public Health Ordinance. Some of the doctors patrol outlying areas and all make use of the Northwest Territories radio system in prescribing for those who are unable to obtain treatment at the medical centre.

HOSPITALS

During the year, 11 hospitals were operated in the Territories, 9 by missions of the Roman Catholic Church and the Church of England in Canada and 2 by mining companies at Yellowknife and Port Radium. Hospital facilities were also provided by private enterprise at Norman Wells for those engaged on the Canol Project and related activities.

The mission hospitals were situated at Fort Smith, Fort Resolution, Hay River (sick bay), Fort Simpson, Aklavik (2), Rae, Chesterfield, and Pangnirtung. By special arrangement, the Northwest Territories Administration paid the mission hospitals $2.50 per diem for the care of indigent whites and half-breeds who were admitted on the recommendation of the resident medical officers. In the case of patients suffering from venereal disease, $3 was paid for in-patients, and $1 per diem for out-patients. The aged and infirm are cared for in industrial homes operated in conjunction with the mission hospitals at Aklavik, Chesterfield, and Pangnirtung. These inmates were also admitted on the recommendation of the Government medical officer, and the missions received $200 per person per annum for their care and maintenance until January 1, 1947, when payment was increased to $400 per person per annum. During the year, the sum of $16,291.74 was expended for the care of destitute patients in the hospitals, representing approximately 6,875 days of treatment. Thirty-eight patients were accommodated in the industrial homes at a total cost of $6,875.47, and nine insane patients, together with a number of indigents, were treated in provincial institutions at a cost of $5,358.36. The above figures do not include the amounts paid by the Indian Affairs Branch for services to Indians only. A considerable drop in expenditure was effected by the action of the Department of National Health and Welfare in taking over the hospitalization of Eskimos.

SCHOOLS

Residential and day schools are operated by the Church of England and the Roman Catholic missions. The residential schools are located at Fort Resolution, Fort Providence, and Aklavik (2), and the mission day schools are located in the principal settlements. Owing to the nomadic tendencies of the natives, some of the day schools in the outlying areas are operated only during periods of the year when the natives are in the vicinity. During the year, 135 children attended the residential schools and 411 pupils attended the day schools. Public schools were operated at Fort Smith and Yellowknife and were attended by a total of 181 pupils.

Grants totalling $26,351.51 were paid to the various schools and for the maintenance of indigent children in the residential schools. Quantities of school supplies were also furnished.

As the Northwest Territories Administration is responsible for the welfare of all Eskimos, arrangements have been made for the maintenance of a number of destitute children in the residential schools at Fort George, Quebec, and Moose Factory, Ontario. School supplies were also furnished to a number of mission schools operated within Eskimo territory of the Province of Quebec.

The above figures do not include amounts paid by the Indian Affairs Branch for the maintenance of Indian children.

During the year, the school inspector made an inspection of the educational facilities in the Mackenzie District, and steps are being taken to implement the recommendations made following this tour of inspection. Plans were also drawn up for the construction of a modern public school at Yellowknife, with provision for instruction in several lines of vocational training.

LAW AND ORDER

Law and order in the Territories are maintained by the Royal Canadian Mounted Police. Detachments are stationed at the more important settlements and extensive patrols are made to outlying areas. To facilitate the administration of justice, four Stipendiary Magistrates and several Justices of the Peace have been appointed.

EASTERN ARCTIC PATROL

The Eastern Arctic Patrol for 1946 sailed from Montreal on July 6 on the Hudson's Bay Company vessel R.M.S. *Nascopie*. After calling at posts on Hudson Strait and on the west coast of Hudson Bay, the vessel reached Churchill, Manitoba, on August 14. Passengers were exchanged and coal, freight, and supplies were loaded for the northern part of the voyage. Stops were made at nineteen ports of call and the distance covered before returning to Montreal on October 3 was 10,600 miles. J. G. Wright, Superintendent of the Eastern Arctic, Bureau of Northwest Territories and Yukon Affairs, was Officer in Charge of the Patrol.

Medical arrangements connected with the patrol were in charge of Dr. H. W. Lewis, of the Department of National Health and Welfare, which is responsible for the medical care and hospitalization of Indians and Eskimos. Dr. George Hooper, of Ottawa, joined the Patrol at Churchill and acted as surgeon on the northern portion of the voyage, which included calls at the only two hospitals in the region—the Roman Catholic mission hospital at Chesterfield and the Anglican mission hospital at Pangnirtung. By arrangement with the Canadian National Institute for the Blind, an eye-specialist group again accompanied the Patrol. Dr. J. F. A. Johnston, a Toronto ophthalmologist, headed the eye group sailing from Montreal and was relieved at Churchill by Dr. W. L. Crewson, of Hamilton, who was in charge of this work in 1945. This group improved the vision of many Eskimos. The ship's dentist treated a number of patients at all ports of call. The Department of National Health and Welfare supplied X-ray equipment and Dr. Lewis and his associates were able to take over 1,500 chest X-ray plates as part of a general survey of tuberculosis conditions among the Eskimos.

The health of the Eskimos was found to be generally good although in some areas there appeared to be a high infant mortality. It is hoped that this condition can be alleviated in future by the supplying of proper foods for small children.

The *Nascopie* and auxiliary schooners carried mail and medical and other supplies to all ports in the Eastern Arctic, and relief personnel for Royal Canadian Mounted Police detachments and weather and radio stations. Several buildings at the air base at Southampton Island were dismantled and moved to Chesterfield for transhipment to Baker Lake and re-erection as a group of ten buildings to comprise an Arctic research station. Unfortunately, owing to transportation difficulties in the Arctic, they did not reach Baker Lake in time to be erected before winter set in.

A radio transmitter was installed at the Royal Canadian Mounted Police post at Dundas Harbour, which had been without radio communication with the outside world for the past year.

Through the co-operation of the Royal Canadian Air Force, the Officer in Charge of the Patrol, accompanied by the medical and eye group, was flown from Churchill to Eskimo Point and Baker Lake, points not visited by the *Nascopie*.

Liquor Permits

Operation of the Territorial liquor stores at Yellowknife and Fort Smith was continued by the Saskatchewan Liquor Board as agent for the Northwest Territories Administration. Additional quantities of liquor became available during the year, permitting an increase in quantities rationed to individual permittees. There was a substantial gain in the business at the Yellowknife store. The beer sales at the store and at licensed hotel premises in the settlement increased more than 300 per cent. The volume of business at the Fort Smith store also increased, but not to the same extent as at Yellowknife.

Net profits from the operation of the liquor stores during the fiscal year amounted to $206,227.77 as compared to $125,485.01 in 1945-46. Profits from the Yellowknife store were $158,620.29 and from the Fort Smith store, $47,607.48. Profits from liquor sales and permit fees in the Mackenzie District, together with $3,330 derived from fines under the Territorial Liquor Ordinance, were placed in the special liquor account for Territorial purposes. The balance in this account as of March 31, 1947, was $587,957.74. The sum of $94 was obtained from the sale of liquor permits issued at Ottawa.

During the fiscal year, 5,345 Class "A" annual permits were issued in the Northwest Territories. Liquor permits issued at Ottawa were 4 Class "B" permits covering sacramental wine and 48 Class "C" permits authorizing the importation of limited quantities of spirits, wine, and beer. Sales at the Territorial liquor stores during the fiscal year were approximately 9,220 gallons of spirits, 1,352 gallons of wine, 9 gallons of ale and stout, and 101,050 gallons of beer. Importation permits covered 98 gallons of spirits, 192 gallons of wine, and 105 gallons of beer.

Lands and Timber

Land Sales.—Twenty-five settlement lots were sold and patented as follows: Aklavik (Pokiak Subdivision) 4; Arctic Red River 2; Fort Norman 2; Fort Smith 2; Hay River 12; Taltson River 3. In addition, one group lot comprising 97·6 acres was sold in Group 862.

Leases and Permits to Occupy (Surface Rights).—There are now in force 632 leases and permits to occupy. Of these, 542 are for land in the Yellowknife Administrative District and the remainder for land at various points throughout the Northwest Territories. The types of leases and permits are as follows: residential and business purposes 607; agricultural leases 13; grazing leases 3; fur-farm leases 9. Leases are authorized by Order in Council and generally are issued for a term of five years, with a renewal option for a further five years. Permits to occupy unsurveyed Dominion Lands are issued subject to cancellation upon the serving of a stipulated notice.

Assignments.—During the year, 50 assignments affecting lands were registered in the Department.

Hay Permits.—Five hay permits were issued under which 83 tons of hay were cut.

Timber.—Ninety-six timber permits, exclusive of those granted in connection with timber berths, were issued authorizing the cutting of 4,880 linear feet of timber, 20,000 feet board measure of lumber, 205 fence posts, and 5,397 cords of wood. Of these permits, 41 were issued free of dues to educational, religious, and charitable institutions; to settlers for domestic use, and to Government Departments. Twenty-four timber berth permits were granted during the year and 2,373,744 feet board measure of lumber were manufactured, together with 105,557 linear feet of timber and 3,223 cords of wood.

Revenue.—Total revenue derived from lands, timber, grazing and hay was $42,671.78.

Forest and Wildlife Conservation

The relatively dry summer of 1946 and low water levels throughout the Mackenzie District in general created fire-hazard conditions requiring close supervision by the Forest and Wildlife Service. Fifty-eight forest fires were reported during the year, of which 48 occurred along waterways and other routes of travel. Many of them were attributable to the failure of travellers to extinguish camp-fires. The three most serious fires destroyed valuable forest cover in the Point Separation area, Mackenzie Delta; in the Providence District; and south and west of Fort Resolution. A large number of fires occurred in the mining and prospecting areas of the Yellowknife district.

The protection service established in the Mackenzie District during 1945 under the immediate direction of E. G. Oldham, Superintendent of Forest and Wildlife Management, was strengthened by the addition of a forest engineer, J. S. Prescott, and a number of new park wardens. The Mackenzie River area has been divided into five districts for the purpose of convenient supervision and fire suppression, as follows: Aklavik, Fort Norman, Fort Simpson, Fort Resolution, and Yellowknife.

Under the direction of the Department of Public Works, park wardens' cabins were erected at Fort Resolution, Fort Simpson, and Fort Norman. Supplies were also delivered to Aklavik for erection of a cabin at that point. The new park wardens were given a period of training at Fort Smith under the direction of the Superintendent and were assigned to the above districts in September, 1946. The wardens were equipped with small patrol boats and modern fire-fighting equipment. Arrangements were made to establish a park warden in the Yellowknife area in 1947. The latter officer will be provided with a heavy-type boat suitable for use on Great Slave Lake in transporting crews and equipment in connection with fire-suppression work in the Fort Rae and Yellowknife areas.

One patrol boat only, the M.B. *Caribou,* of about ten tons, was available for use on the Mackenzie River for fire-suppression purposes during 1946. Three specially-designed tunnel type launches ordered for use on the Mackenzie, Slave, and Liard Rivers were not delivered due to difficulty in obtaining the necessary construction materials.

The total area burned during the year was estimated at 1,452,487 acres, of which 285,883 acres contained timber having an estimated merchantable value of $223,497. Much of the area burned contained immature, potentially merchantable timber which provided cover for the wildlife. Forest fires are to a large degree responsible for the reduction in the beaver and muskrat population in many valuable fur districts. The natural food of many big game animals has also been destroyed. These conditions have an important bearing upon the livelihood of the natives, who of necessity have had to depend more and more on the barren ground caribou for food and clothing.

A Fox-Moth aeroplane was chartered and made available to the Superintendent of Forest and Wildlife Management for reconnaissance purposes throughout the summer. The aircraft was used to transport crews and fire-suppression equipment. The organization succeeded in extinguishing a number of fires before they assumed serious proportions.

Fur Production

There was a noticeable increase in the number of muskrat pelts taken as compared with the previous year. The yield of muskrat pelts in 1946 was valued at $448,912, as against $288,248 in 1945. There was a slight increase in the number of beaver taken. A very noticeable decrease in the number of fox, lynx, and mink was apparently due to cyclic causes.

A. W. F. Banfield, of the National Parks Bureau, carried out a preliminary investigation of the muskrat habitat of the Mackenzie Delta in preparation for a more extensive biological survey to be undertaken next year. Evidence of a local disease affecting the muskrat was obtained, and the subject has been noted for investigation during the course of the biological survey.

The close season for the taking of marten remained in effect throughout the year. Some evidence was produced indicating an increase in the marten population in some of the remote districts, but the general situation throughout the extensive hunting grounds does not seem to warrant any relaxation of the close season provision.

The trapping of beaver with a bag limit of ten animals to native and resident trappers was permitted in that part of the Mackenzie District north and west of the Liard River and west of the Yellowknife Game Preserve. The reports indicate some improvement in the beaver situation in this territory. Elsewhere conditions have not improved to such an extent that modification of the close season provisions of the regulations could be justified.

WOOD BUFFALO PARK

Conclusive evidence of the serious damage to forests in the northern area of the park due to fires that occurred during the years 1943 and 1945 was found during extensive investigations. It is estimated a minimum of fifty per cent of the timbered area was burned from 1941 to 1945 inclusive. The extensive damage to the forest cover resulted in total destruction of the beaver and muskrat habitat in certain areas and immeasurable loss to the native population through diminishing fur returns. The lack of transportation facilities, the absence of suitable roads and trails, and inability to obtain labour during the war years had made fire prevention work impossible.

The road between Fort Fitzgerald and the Government Station at the Hay Camp on the Slave River, a distance of 32 miles, was reconstructed under the direction of J. H. Atkinson. Two dump trucks and two general utility trucks were purchased for use on this road program. In addition, a D-7 Caterpillar tractor and angledozer was rented and used for a period of two months. It is the intention to extend the roads and trails as needed to facilitate the patrolling and supervising of the park area.

The work program also included the construction of new cabins for accommodation of park wardens at Chipewyan; on the south side of the Peace River near Fifth Meridian; at the Government Station at Hay Camp; and at the intersection of Salt River Road with the Little Buffalo River.

Observations made at various times during the year showed that the greater part of the buffalo population was occupying grazing areas in the southern part of the park to the north and west of Baril Lake and Lake Claire. A few small buffalo herds remain in the northeasterly part of the park and a herd of about two hundred animals is located between the Slave and Taltson Rivers within the boundaries of the Slave River Game Preserve.

Following investigations made at various times during the year, the Superintendent estimated the buffalo population at 7,500 head. These animals are healthy and the number of calves was estimated at between twenty and thirty per cent. Notwithstanding the severe drought conditions that have existed in recent years the Superintendent advised that there was no evidence of over-grazing. Fifty-five aged and outcast animals were killed during the winter to provide meat for needy natives and for distribution to missions and hospitals maintained and operated in the interests of the native population.

Except for a slight increase in the number of muskrat pelts, there was a reduction in all classes of fur taken by Treaty Indians and half-breeds who were privileged to hunt and trap in the Park.

NORTHWEST GAME REGULATIONS

By Order in Council (P.C. 5114) dated December 12, 1946, amendments to the Northwest Game Regulations were made as follows:—

(*a*) The open season for the taking of muskrats north of the Arctic Circle will terminate on the 8th day of June instead of the former date, the 15th day of June.

(*b*) The killing of moose, mountain sheep, or mountain goat of the female sex was prohibited.

(*c*) The killing of male moose, mountain sheep, or mountain goat under one year of age was prohibited.

(*d*) The sale of moose meat was prohibited.

GENERAL

Seven fur farms were licensed to operate in the Northwest Territories during the fiscal year.

Comparative figures of the number of big game animals and birds taken during the licence years ended June 30, 1945 and 1946, follow:—

—	Year ended June 30	
	1946[2]	1945[1]
Big Game—		
Caribou	28,212	28,704
Deer	1	44
Moose	595	790
Sheep	13	44
Goat	2	5
Game Birds—		
Ducks	10,077	11,850
Geese	423	656
Grouse	446	198
Partridge	548	489
Prairie chicken	1,620	696
Ptarmigan	6,173	5,945

Licences, Permits and Revenue.—Comparative statement of licences and permits issued and revenue derived under the Northwest Game Act.

—	Licences Year ended June 30	
	1947[2]	1946[1]
Hunting and Trapping—		
Resident	420	476
Game Bird	49	33
Trading and Trafficking—		
Resident	104	124
Non-resident	4	3
Non-resident—(non-British)	1	1

—	Permits Year ended June 30	
	1947[2]	1946[1]
To establish trading posts in Northwest Territories	11	8
To take animals for propagation purposes	1	2
To take migratory birds	10	5
To take scientific specimens	4	3
To take (10) beaver	263	476
To Indians to hunt and trap in Wood Buffalo Park	214	296

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[1] These figures may differ slightly from those recorded in the Annual Report for 1945-46 because of additional returns received after that report was printed.

[2] Subject to revision as additional returns are received.

Revenue.—Revenue under Northwest Game Act for fiscal years ended March 31, 1946 and 1947, is shown hereunder:—

—	Fiscal Year	
	1946-47	1945-46
Hunting licences	$ 900 00	$ 994 00
Trading licences	1,580 00	1,386 90
Bird licences	102 00	78 00
Fur farm licences	13 00	15 00
Trading post permits	7 00	6 00
Sale of furs	6,893 80	3,341 50
Fur export tax	90,894 44	56,834 64
Permit to export live fur bearers	....	100 30
Fines and forfeitures	3 00	90 00
Sub-total	100,393 24	62,846 34
Revenue under the Businesses, Callings, Trades and Occupations Licence Ordinance, fiscal year ended March 31, 1947	8,915 57	5,875 50
Sale of buffalo hides	795 00	741 00
Total	110,103 81	69,462 84

Infractions of Game Laws.—There were 5 prosecutions for infractions of the game laws. Convictions were secured in 4 cases.

REINDEER

The herding of reindeer as a native industry in northern Canada is being fostered by the Dominion Government through the Northwest Territories Administration. The enterprise commenced with the delivery in 1935 of a herd of 2,370 reindeer from Alaska to a reserve on the east side of the Mackenzie Delta. There are now a main herd on the reserve and a subsidiary herd about 200 miles eastward near the mouth of the Anderson River. The field organization consists of about 20 men for supervision, labouring, and herding, with buildings, corrals, boats and other needed equipment. Wireless communication is used to a large extent. The herders are mainly Eskimos, assisted by two Laplanders.

At the roundup of the herds in July, 1946, there were 4,114 deer in the main herd and 2,402 head in the Anderson River herd. In the autumn of 1946, the usual donation of 100 carcasses was made to the mission hospitals and residential schools at Aklavik. Other reductions for meat purposes amounted to more than 300 head, and in addition, ordinary losses from sickness, injury, and predators occurred. The revenue from the sale of reindeer products (meat and skins) during the fiscal year amounted to $7,480.56. Skins shipped to the Eastern Arctic numbered 220.

Investigations with a view to determining the best methods of developing the reindeer industry in the interests of the natives were continued during the year. Efforts are being made to secure improved field management, to recruit more young natives for reindeer training, to improve the technique of handling large herds, and to develop a suitable procedure for marketing, storing, and shipping surplus reindeer products. A recheck of the range is to be undertaken.

MINING

Mining and prospecting in the Northwest Territories during the year were confined mainly to the Yellowknife area, although a revival of prospecting interest in the area immediately to the west of Hudson Bay was evident. This area had been dormant for many years but during 1945 representatives of one of the large mining companies, the Hudson Bay Mining and Smelting Company Limited, staked and recorded 80 mineral claims scattered over a fairly large area. Additional prospecting and development work was carried on during 1946. There was also a revival of interest in the sub-Arctic region between Bathurst Inlet and the Arctic Circle. Considerable exploration was done and upwards of 100 claims were recorded in this area.

Progress was made on two projects which are expected to influence the development of mineral resources in the Northwest Territories, namely the Grimshaw-Hay River road which is expected to be completed by the end of 1947, and the Snare River hydro-electric power development, which is scheduled for completion by the end of 1948.

The number of mineral claims staked and recorded in the Territories during the year was considerably less than in the preceding year. Interest was transferred to the development of claims staked in previous years. This situation was illustrated by the number of Certificates of Work issued, which increased more than fifty per cent during the 12 months ended March 31, 1947. The total revenue derived from fees collected under the various mining regulations for the year ended March 31, 1947, amounted to $222,908.45, as compared to $184,019 for the previous year. The 1946-47 revenue was divided as follows:—

Quartz Mining—		
General fees	$ 99,867 46	
Leases	2,460 20	
Royalties	3,976 10	
Miner licences and renewals	61,937 25	
		$168,241 01
Petroleum Natural Gas—		
Leases	2,132 56	
Royalties and Government share in production of the "Proven Field"	52,362 88	
		54,495 44
Coal—		
Permits		26 00
Gravel—		
Permits		146 00
		$222,908 45

In August, 1946, the Con and Rycon mines were again brought into production after a shutdown of over three years and, together with the Negus mine, which was in production for the whole year, contributed to a very marked increase in the total gold and silver production of the Territories. The Thompson-Lundmark and Philmore Yellowknife (successors to International Tungsten) mines, which also were shut down during the war period, were reported as being in preparation to resume production. Development work on the Giant Yellowknife property was further advanced. Two shafts, situated one mile apart and 520 feet and 409 feet deep, respectively, were completed, in addition to 4,000 feet of lateral development. It was reported that a plant capable of milling 500 tons a day would be in operation some time during 1947. A careful geological investigation led to a deep drilling program on the "Con" and Negus properties jointly financed by the two companies and it was reported that at a depth of more than 2,000 feet a large ore body, presumed to be the extension of the Giant ore body, was discovered. The owners of several other promising prospects were engaged in shaft sinking and underground development.

Work on the Crestaurum development, situated at the northern end of an extension to the Giant Road, was suspended after a shaft had been sunk to a depth of 421 feet, and 300 feet of lateral work had been done. No reasons were advanced for this step, but it was assumed that a shortage of labour and supplies was responsible. It was expected that this property would be reopened when labour became more plentiful and hydro-electric power became available.

The Yellowknife field in general showed steady expansion, and major development work was being carried on in the Indin Lake and Beaulieu River areas. Reports of a new rich find led to considerable staking in the vicinity of MacKay and Courageous Lakes, a new area about 150 miles northeast of Yellowknife. Operations were continued at the pitchblende-silver property of Eldorado Mining and Refining (1944) Limited throughout the year. About 200 people were employed and the concentrates produced were shipped to Port Hope, Ontario, for refining. Production figures were not available for publication.

VALUE OF MINERAL PRODUCTION

The value of mineral production in the Northwest Territories for the past four years, together with the total value of production since 1938 to date, is indicated by the following figures which have been supplied by the Dominion Bureau of Statistics:—

—	1943	1944	1945	1946	Total Production to end of 1946
	$	$	$	$	$
Gold	2,272.732	799,838	333,218	860,685	15,204,304
Silver	5,996	5,881	956	5,113	842,636
Lead	....	....	....	....	490
Copper	....	1,428	....	....	24,102
Tungsten	729	....	....	....	37,674
Pitchblende products	†	†	†	†	5,805,423†
Crude petroleum	400,201	632,587	136,303	173,392	1,818,496
Natural gas	335	335	335	335	3,595
	2,679,993	1,440,069	470,812	1,039,525	23,736,720

† The value of pitchblende products, including radium and uranium, for the years 1942 to 1946, inclusive, is not available for publication.

During the fiscal year, 1,028 miner's licences and 1,169 renewals of miner's licences were sold; 5,715 quartz grants were issued, and 5,806 assignments and transfers of mineral claims were recorded. In addition to the above, 15 leases comprising 810·80 acres were issued under the Quartz Mining Regulations.

Coal.—There were no coal mining leases in force during the year, but three domestic coal mining permits were in force in the unorganized districts of the Territories.

Petroleum and Natural Gas.—All permits issued under the regulations approved by Order in Council P.C. 2904, dated April 27, 1944, and comprising 2,241,638 acres on the Mackenzie River in the vicinity of Norman Wells, were abandoned after an extensive but unproductive exploratory drilling program had been carried out. After these abandonments, only one permit issued under the regulations remained. This permit comprised 640 acres situated on the Hay River. Six leases, comprising 3,279·23 acres and the proven field, 7,939 acres, were still in good standing. Operations in the proven field produced 214,832 barrels of oil during the year, making a total production since April, 1942, of 1,939,463 barrels. Royalties, together with the Government's share of the proceeds of the sale of the oil, amounted to $39,119, making a total revenue of $52,362.88 from this source since the proven field agreement came into force.

Dredging.—Two five-mile stretches on Grizzly and Bennett Creeks, tributaries of the South Nahanni River, were the only dredging leases in good standing in the Northwest Territories. The combined annual rental of these two leases is $100.

YELLOWKNIFE ADMINISTRATIVE DISTRICT

During the year, the Local Trustee Board of Yellowknife Administrative District held 33 meetings and passed several by-laws including those covering such matters as assessment of property and rate of taxation within the District, prevention of fires, the installation of electric wiring, and burial of the dead. Many other matters of interest to the community were also discussed and passed by the Board.

Townsite Development.—Several areas were surveyed as additions to the townsite as laid out in 1945, and the unoccupied and suitable areas lying between the original settlement and the 1945 subdivisions were surveyed for utilization as residential and industrial sites. The total number of lots in all subdivisions of the townsite is 1,172. There is a fairly constant demand for lots and, during the year, 336 applications for lots were received.

Preliminary work was completed on a proposed water and sewer system to serve the new townsite, and this is to be built in 1947. During the summer of 1946, water was supplied to the old townsite through 4,000 feet of surface lines and a similar system was constructed to serve the new townsite in 1947.

Although building activity was hampered by a shortage of materials, approximately one hundred new homes and many substantial business premises were erected. In addition, various Government departments erected buildings for office and staff purposes. Arrangements were made for the construction in 1947 of a forty-bed hospital and a consolidated school.

PUBLIC IMPROVEMENTS

Work on the Grimshaw-Hay River Highway, the cost of which is being shared by the Dominion Government and the Government of Alberta, was commenced in 1946 and by the end of the year approximately 194 miles of clearing and 86 miles of grading had been completed. The work schedule calls for completion of the highway by the end of 1947.

Good progress was made on the hydro-electric power development on the Snare River, approximately 90 miles north of Yellowknife Settlement. At the end of the fiscal year, the main power tunnel, 136 feet in length, and a small exciter tunnel had been driven to completion. The coffer dam across the northwest channel was constructed and borrow pits for the rock fill were opened up. A large amount of material was landed by barge near Fort Rae in the summer and transported by tractor train to the power site during the winter. Construction of the dam and foundations of the power-house was anticipated following breakup in the spring of 1947. Construction of the transmission line from the site of the power-house to the main camp of Giant Yellowknife Gold Mines, Limited, was also under way. Additional details of this development will be found in the report of the Surveys and Engineering Branch.

Airport access roads at principal settlements were maintained by the Department of Transport from funds provided by the Northwest Territories Administration. At Yellowknife the Department of Transport completed roads between the airport at Long Lake and Yellowknife Settlement, a distance of four and a half miles, and between the airport and radio range.

The two portage motor roads connecting Fort Fitzgerald, Alberta, and Fort Smith were kept in serviceable condition with equipment owned by the Northern Transportation Company Limited and the Department of Transport.

In the Yellowknife district, the road connecting property of Giant Yellowknife Gold Mines Limited and the new townsite addition, and an extension of this road to the property of Crestaurum Mines Limited, were completed. The road program within the settlement of Yellowknife was brought to completion under the direction of the Department of Public Works, and existing roads were improved by grading, surfacing, and drainage. The town and district are now serviced by excellent all-weather roads, towards which financial contributions were made by the Northwest Territories Administration.

Landing fields for aircraft along the Mackenzie River Route in the Mackenzie District were maintained at Fort Smith, Fort Resolution, Hay River, and Yellowknife by the Department of Transport, which also provided meteorological services and facilities for refuelling. Fields at Fort Simpson and Norman Wells were serviced by Canadian Pacific Air Lines Limited. Construction work was continued on the Yellowknife airport by the Department of Transport and included the completion of the 4,000-foot NW-SE landing strip, and the clearing and grading of the N-S landing strip to a length of 3,000 feet. A radio range was completed at Yellowknife and came into operation on March 1, 1947.

The Meteorological Division of the Department of Transport continued the operation of weather stations established in the Territories, including upper air observing stations at Aklavik, Norman Wells, Fort Smith, Southampton Island, and Arctic Bay. Further progress was made in arranging for the establishment of an upper air observing station to be located at Coppermine. Much of the material necessary for the construction of this station was on the site at the end of the year, and it was expected that operations would be commenced during the summer of 1947.

Two new meteorological stations were opened during the year—one at Baker Lake in Keewatin District (operated in co-operation with the Department of National Defence) and one at Eureka Sound, Ellesmere Island, in Franklin District (operated as a joint project with the United States Government). Surface observations only are taken at Baker Lake, while at Eureka Sound upper air observations are also taken.

As a result of increasing demands for meteorological information from the Canadian Arctic, negotiations were undertaken with the United States Government with a view to establishing additional weather stations. Plans assure the establishment of a base station at Winter Harbour during the summer of 1947. Meteorological observations will include both surface and upper air. It is proposed to establish subsidiary stations during 1948.

The Department of Transport continued the maintenance of aids to navigation along portions of the Mackenzie River waterway including points on the Slave River, Great Slave Lake, the Mackenzie River, and Great Bear Lake. The service was improved by the establishment of a new flashing electric light on Hardisty Island at the western entrance of the North Arm and by the provision of an electric lighted buoy for the marking of the Mackenzie Rock—both in Great Slave Lake. A new 65-foot twin-screw, tunnel-stern steel lighthouse and buoy tender for service on Great Slave Lake and the upper Mackenzie River was under construction in 1946. It is expected that the new craft will be in operation in July of 1947.

A franchise for a telephone system has been granted by the Yellowknife Administrative District, and it is planned to have the system in operation by the end of 1947.

The Royal Canadian Corps of Signals maintained the system of wireless communication in the Territories, made up of radio stations extending from Alberta to the Arctic Ocean. This system provides an outlet for additional stations owned and operated by commercial organizations such as mining, transportation, and trading companies. Connections were also maintained with Department of Transport stations, the Alaska Communications System, and with Canadian commercial telegraph companies at Edmonton.

SCIENTIFIC SURVEYS

During the year, the Geological Survey had six parties in the field. One of these commenced 4-mile reconnaissance mapping in the Camsell River area so as to assist in the exploration and delimitation of the uranium-bearing province bordering the southeast shore of Great Bear Lake. Another party commenced similar mapping some 200 miles northeast of Yellowknife, in the Lac de Gras area, which embraces an interesting gold belt. Geological mapping was started at a scale of 1 inch to 1 mile, in the active Indin Lake gold area; and on a more detailed scale, on the Negus-Giant gold belt at Yellowknife Bay. The remaining two parties continued detailed investigations in the vicinity of Eldorado mine. This work, done in close co-operation with the Crown company, Eldorado Mining and Refining (1944) Limited, was designed to aid in the discovery of uranium-bearing minerals. In addition, three Topographical Survey parties were engaged near Indin Lake, east of Yellowknife, and at Yellowknife, and provided the control necessary to compile detailed base maps of these areas.

Inspection of oil operations in the Norman Wells field was continued during the year by the Department of Mines and Resources. Geological parties of Imperial Oil Limited and Socony-Vacuum Oil Company continued geological exploration for petroleum. Imperial Oil Limited had three parties working in the lower Mackenzie River and Delta regions between the Arctic Red and Anderson Rivers. The company also undertook wildcat drilling at Whirlpool on the Mountain River, and on the Redstone River—both tributaries of the Mackenzie River—without success. Socony-Vacuum Oil Company had four geological parties working in the vicinity of the Peel River and the Richardson Mountains.

Surveys made by the Hydrographic Service included the Providence Rapids section of the Mackenzie River from Fort Providence to Beaver Lake. The harbour approach to Hay River settlement was sounded and reconnaissance surveys were made of two possible harbours on the west shore of Great Slave Lake. Harbour surveys were also carried out by the Department of Public Works at Buffalo River, Hay River, and several points on the north shore of Great Slave Lake with a view to improving existing facilities.

During the year a preliminary edition of the *Mackenzie River Pilot* was issued, and a revised edition of the chart entitled *Plans of Harbour, Great Slave Lake* was prepared. Hydrometric investigations were also extended systematically in the Great Slave Lake area by the Dominion Water and Power Bureau.

Legal surveys were made of the landing fields at Fort Smith and Fort Providence, and at the settlements at Fort Smith, Hay River, Yellowknife, Aklavik, and Rat River. The work at Hay River settlement included the survey of four townsite blocks consisting of 40 lots.

AERIAL MAPPING

Approximately 37,000 square miles were covered by vertical aerial photography undertaken by the Royal Canadian Air Force during the year.

In the immediate vicinity of Yellowknife, an area of 40 square miles was photographed on a scale capable of enlargement to 200 feet to the inch to provide sufficient detail for road and subdivision planning.

In connection with the development of the reindeer industry, and to permit a study of the terrain, an area of approximately 20,000 square miles was photographed north and east of Great Bear Lake.

For mapping and administrative purposes, and in connection with the economic development of the mineral resources, further photographs were taken covering the Whitehorse and Watson Lake areas, and east of Great Slave Lake, totalling 17,000 square miles.

AGRICULTURE

Following the exploratory soil surveys of the lands adjacent to the Mackenzie and Liard Rivers in 1944 and 1945, the Joint Committee on Northern Agriculture recommended the establishment by the Experimental Farms Service of a main experimental sub-station at Fort Simpson and a smaller sub-station at Yellowknife. Activities in 1946 were limited to the securing of land at these points, inspection of the proposed sites, and the purchase of necessary equipment and supplies for development of the stations in 1947. J. A. Gilbey, a former member of the Experimental Farms Service, and latterly in charge of agricultural work undertaken by the Canadian Army at Goose Bay, Labrador, was appointed officer in charge of the new sub-station at Fort Simpson.

A detailed report of the exploratory soil survey of the Mackenzie and Slave Rivers conducted in 1945 has been delayed pending receipt of chemical analyses, and its preparation will be undertaken in 1947.

Twenty-two co-operators were selected to carry out vegetable trials in the Northwest Territories in 1946, including representatives at Fort Smith, Fort Resolution, Hay River, Yellowknife, Fort Providence, Trout River, Fort Simpson, Fort Norman, Norman Wells, Fort Good Hope, Fort McPherson, and Aklavik. Vegetable samples distributed consisted of three varieties of beets, four varieties of cabbage, and four varieties of carrots. Insecticides, pamphlets, and report forms were also included. At the end of the fiscal year reports from co-operators were not complete.

COMMERCIAL FISHERIES

Commercial fishing for whitefish, lake trout, and inconnu was continued at Great Slave Lake by McInnes Products Corporation Limited during the summer season of 1946, and a total catch of 2,387,000 pounds (round weight) was reported. Fishing was extended over a larger area than in 1945, nets being set south from Yellowknife Bay to Output Island, and west from Blanchet Island to Gypsum Point on the west shore of the lake. All fish caught were landed at a processing plant located at Gros Cap and operated by the company.

The plant consisted of one large work barge and two freezer barges for quick-freezing operations. The frozen product was transported in refrigerator barges across Great Slave Lake and up the Slave and Athabaska Rivers to Waterways, Alberta, for shipment by rail to southern markets.

During the summer of 1946, biological investigations of the waters of Kakisa and Tathlina Lakes, southwest of Great Slave Lake, were undertaken by officers of the Department of Fisheries and the Fisheries Research Board of Canada, for the purpose of determining whether or not these lakes were capable of supporting a commercial fishery. The investigation of Tathlina Lake indicated a fish population of whitefish, dore (pickerel), northern pike, suckers, and burbot. In view of the lack of fish of commercial size, the opening of the waters to commercial fishing was not recommended until a further survey, possibly three years hence, could be undertaken to determine the development of the fish population.

The survey of Kakisa Lake showed dore, suckers, whitefish, northern pike, and ciscoe present, the volume of abundance being in the order named. A recommendation was made that consideration be given to the opening of Kakisa Lake to commercial fishing for dore. Subsequently, a permit was issued by the Department of Fisheries authorizing a winter catch in the lake not to exceed 200,000 pounds of dore, dressed weight. An ichthyological survey of Great Slave Lake was continued by the Fisheries Research Board of Canada. An interesting feature was a sounding of 2,400 feet taken within one-half mile of the shore in the western end of the lake.

Winter commercial fishing at Great Slave Lake was permitted for the first time during the winter of 1946-47, with a set limit of 1,000,000 pounds (dressed weight) of whitefish and trout. A further 593,942 pounds was carried over from the summer limit, making a total limit of nearly 1,600,000 pounds of whitefish and trout available to fishermen at the beginning of operation in December.

Twenty-seven licensed fishermen operated in the Yellowknife Bay area from the West Mirage Islands to Wrigley Point on the south shore of North Arm. Nets were set in from 36 to 140 feet of water. Deep water sets produced the heaviest catches of whitefish and trout, with only occasional inconnu being taken. Shallow water sets caught too many pike and suckers to be economically profitable. In view of the fact that the winter of 1946-47 was one of the most severe on record, fishing was carried on under the most difficult conditions. Transportation arrangements could not be completed and, in consequence, the entire catch of approximately 100,000 pounds in this area was lost.

A more successful operation was conducted in the Hay River area by an Alberta firm employing twenty licensed fishermen. The catch was hauled by truck over the Grimshaw-Hay River road and, toward the end of the season in March, fresh fish were hauled to the railhead at Peace River, a distance of 410 miles, in eighteen hours.

The winter commercial production from Great Slave Lake has been estimated as follows:—

Species	Fresh (pounds)	Frozen (pounds)	Total (pounds)
Whitefish	25,200	138,784	163,984
Trout	3,360	53,211	56,571
Inconnu	6,780	24,100	30,880
Pike		380	380
Pickerel	....	150	150
Totals	35,340	216,625	251,965

Deep snow and severe weather conditions discouraged commercial fishing for dore (pickerel) at Kakisa Lake.

Geographic and Economic Research

Studies dealing with the geography, natural resources, and peoples of the Northwest Territories were continued by the Bureau's geographer, aided by an assistant. Considerable time was devoted to research relating to the history and exploration of Mackenzie District, following which an article *Exploration and Settlement of Mackenzie District, N.W.T.* was prepared for publication in the Canadian Geographical Journal. Descriptions of the principal settlements in the Canadian Eastern Arctic were also compiled and mimeographed for general distribution.

The compiling and editing of information relating to the natural resources of Newfoundland, supplied by other Government services, were undertaken for the use of the Department of External Affairs.

The Bureau's geographer terminated his employment in August, 1947, to accept a position on the staff of the University of British Columbia.

Publicity and Information

Numerous requests for information about the Yukon and Northwest Territories, and particularly the Yellowknife area, were met by distribution of pamphlets, folders, and maps, and by correspondence. A new illustrated folder describing the mining community of Yellowknife was printed during the year, as well as additional issues of the multilithed publications *The Yukon Territory* and *The Northwest Territories.* Reprints of articles written in the Bureau and published in the Canadian Geographical Journal were purchased for distribution. These articles described in considerable detail the geography, peoples, settlements, natural resources, and industries of the Territories. To meet the demand for information concerning public use of the Alaska Highway, multilithed circulars were compiled and printed for distribution. A bulletin describing the Government reindeer herds was also prepared and mimeographed.

A list of publications printed during the year for general distribution follows:—

The Northwest Territories—Administration, Resources, Development.
The Yukon Territory—Administration, Resources, Development.
Weather and Climate of the Northwest Territories.
Exploration and Settlement of Mackenzie District, N.W.T.
Yellowknife—General Information.
The New North.
Canada's Reindeer Herds (mimeo.).
General Information concerning the Alaska Highway—Canadian Section (multilithed bulletin).

YUKON TERRITORY

Yukon Territory has an area of 207,076 square miles. It is bounded on the south by British Columbia and Alaska; on the west by Alaska (longitude 141 degrees west); on the north by the Arctic Ocean, and on the east by the Northwest Territories. Most of the Yukon's present population is found in three areas; the northern or Dawson District, the southern or Whitehorse District, and the Upper Stewart River or Mayo District. According to the 1941 census, the population of Yukon Territory was 4,914. This figure, however, has been increased by new developments including a revival of the mining industry. The population of the Territory, as estimated in February, 1947, was 7,581.

The Yukon was created a separate territory in June, 1898. Provision is made for a local government composed of a chief executive, called the Controller, and an Elective Legislative Council of three members, with a three-year tenure of office. The Controller administers Government measures and works under instructions from the Governor in Council or the Minister of Mines and Resources. The Controller in Council has power to make ordinances dealing with the imposition of local taxes, sale of liquor, preservation of game, establishment of territorial offices, maintenance of prisons and municipal institutions, issue of licences, incorporation of companies, solemnization of marriages, property and civil rights, administration of justice, and generally all matters of a local and private nature in the Territory. The seat of government is at Dawson, Y.T.

Territorial Council

The Yukon Territorial Council, elected by acclamation for a three-year term in January, 1947, is composed as follows: Dawson District, John R. Fraser, Dawson; Mayo District, Ernest J. Corp, Keno Hill; Whitehorse District, R. Gordon Lee, Whitehorse. The Acting Controller of Yukon Territory is J. E. Gibben, K.C., Dawson.

Work of Council

The Yukon Council met on April 15, and was prorogued on May 9, 1946. The annual supply bill was passed, and new ordinances were approved as follows: Governing the Safe Operation of Mines; Respecting Fair Wages and Hours of Labour for Shop Employees; To provide for a Plesbiscite on the Question of bringing into Force an Ordinance to Incorporate the City of Whitehorse; to Exempt the Mayo Light Plant from Payment of Licence Fee. In addition, the following ordinances were amended: Motor Vehicle, Poll Tax, Forest Fires, Dental, Assessment, and Gasoline and Fuel Oil Tax Ordinances.

Administration

The Lands, Parks and Forests Branch of the Department at Ottawa is responsible for the transaction of business arising from the general administration of the Territory under the Yukon Act and ordinances passed by the Territorial Council; for the disposal of lands under the Dominion Lands Act; for the administration of the Yukon Placer and Quartz Mining Act, and for the collection of revenue.

Revenue and Expenditures

The revenue collected under Territorial Government ordinances during the year amounted to $102,705.19. The amount transferred from the liquor account was $362,700. The sum of $150,000 was transferred from the Yukon Post-War Work Fund. Expenditures from the Yukon Consolidated Revenue Fund amounted to $618,594.88. The Territorial Government received no grant from the Dominion Government during the year.

Mining

Prospecting under both the Placer and Quartz Mining Acts continued in the Territory, and increased activity occurred upon lands administered under the Quartz Mining Act. Great interest was shown in the Nansen-Victoria Creek area which lies west of Carmacks where Brown-McDade, Conwest, and other mining companies carried out a considerable amount of development work. To facilitate operations, a small landing strip for aircraft was prepared by the Brown-McDade Company. In the Mayo District, satisfactory progress was made by Keno Hill Mining Company Limited, successors to Treadwell Yukon Corporation, Limited. Approximately 59 tons of high grade silver-lead ore were produced during the winter months. Two other companies were engaged in underground development and it was anticipated that one or both would be producing during 1947. Other silver-lead deposits were investigated by the Hudson Bay Exploration and Development Company Limited on the Upper Swift River.

Gold production for the year was 57,065·48 ounces, an increase of 17,015·51 over the preceding year. The total gold production, valued at $35 an ounce, amounted to $1,997,291.80, an increase of $595,543 over the preceding year. Practically all gold produced was derived from claims administered under the Placer Mining Act in the Dawson Mining District. A total of 2,676 grants and renewal grants was issued and 446 miles of prospecting leases were granted under the Placer Mining Act. Under the Quartz Mining Act, 826 grants were issued, an increase of 528 over the preceding year, and 774 grants were renewed, an increase of 142 over the preceding year. The total revenue collected from mining in the Territory was $78,677.64, made up as follows: quartz mining fees $14,022.44; quartz mining leases $800; placer mining fees $39,745.06; royalty on placer gold $21,362.12; hydraulic mining leases $2,390; dredging leases $244.30; and coal leases $113.72.

Order in Council P.C. 4574, dated June 4, 1943, which provided for the suspension during the war of representation work required by the Acts and Regulations which control mining in the Yukon Territory, was revoked as of December 31, 1946. As a result of this revocation, representation work upon all mineral grants was obligatory from January 1, 1947. The period in which such work, which came due in the first half of the year 1947, had to be done was extended to July 15, by an order of the Minister of Mines and Resources.

Gold Royalty.—The total amount collected for royalty on gold obtained from placer deposits up to March 31, 1947, was $5,373,483.76, of which $21,362.12 was collected during the fiscal year.

Dredging Leases.—Six leases permitting the lessee to dredge for minerals in the beds of the river in the Territory were in force, and comprised a total length of 34½ miles. The rentals received from this source up to March 31, 1947, amounted to $213,866.27, of which $224.30 was collected during the fiscal year. No new dredging leases were issued.

Hydraulic Mining Locations.—Four hydraulic mining locations are still held under leases issued under the old regulations which were withdrawn by Order in Council dated February 2, 1904. These leases comprise a total stretch of 16 linear miles. Rentals amounting to $223,028 have been collected to date on account of such locations. Of this total, $2,390 was received during the year.

Coal Mining Leases.—There are four coal mining leases in good standing in the Territory, two of which were issued during the year. The revenue from these leases amounted to $113.72.

Quartz Mining Leases.—Twenty quartz mining leases were renewed and two new leases were issued.

PLACER MINING

Of the 2,676 placer grants in good standing, 2,463 were situated in the Dawson Mining District, 81 in the Whitehorse District, and 132 in the Mayo District. The majority of the claims in the Dawson District were held by the Yukon Consolidated Gold Corporation, whose dredges were in operation for a period of 1,036 days, as compared with 536 days during the previous year. The labour requirements of this company are reported to be approximately 700 men for full-scale operations. During the year the company's maximum labour force was 406, and this figure dropped to 310 by the end of August. A total of 5,614,700 cubic yards was dredged by this company during the year.

Yukon Explorations Limited, which was incorporated to take over the assets of the Sunshine Mining Company (Yukon Division), held under lease 113 placer creek claims in the Sixtymile River drainage area, and in addition, 62 miles of placer prospecting leases under option. During the year 400,000 cubic yards of overburden were moved in preparation for dredging. It was reported that approximately 40 men would be employed by the company during 1947.

Yukon Gold Placers Limited continued operations at two camps, at Thistle Creek and Henderson Creek. More than 50 men were employed in preparing for the installation and operation of new steel dredges which were expected to go into production in 1947.

Clear Creek Placers Limited operated from April to November, and employed 24 men. The company's dredge was in operation for 142·6 days and handled 303,040 cubic yards of material, which produced 2,706·56 ounces of gold. A landing strip for aircraft was completed during the year. In the Mayo District, Fred Taylor, operating on Dublin Gulch, produced 608 ounces of gold, using a caterpillar tractor, bulldozer, and gasoline-operated derrick.

In the Whitehorse District gold production from placer operations showed an increase of more than 100 per cent over 1945-46. Most of the gold was produced at Shorty and Burwash Creeks in the Kluane Lake area, the more important producers being Barker and Ray on Shorty Creek, Burwash Mining Company Limited on Burwash Creek, Kluane Dredging Company Limited on Burwash Creek, and Frank MacDougall on Bullion Creek.

LODE MINING

Keno Hill Mining Company Limited made satisfactory progress in working the properties formerly held by Treadwell Yukon Corporation, and at the close of the year employed approximately 90 men. A mill with a daily capacity of 100 tons was operating at 50 per cent capacity and producing five tons of concentrates per day.

Mayo Mines Limited completed about 80 feet of tunnelling in prospecting the "Rio" group of claims. Yukon Northwest Explorations Limited carried on a limited amount of development on their holdings on Keno Hill and Galena Hill.

Operators in the Victoria Creek-Nansen Creek areas in the Whitehorse District included Brown-McDade Mines Limited, Conwest Exploration Limited, Nansen Yukon Mines Limited, Huestis Prospecting Syndicate, and Coleray-Yukon Mines Limited, as well as several individuals. Transportation of equipment and supplies was effected over a winter road connecting the approach road from the Alaska Highway to Aishihik aerodrome.

Active prospecting was continued in many sections of the Whitehorse District, including drilling operations undertaken by Hudson Bay Exploration and Development Company Limited on Logjam Creek and Upper Swift River. It is reported that this company is undertaking the construction of an access road from the Alaska Highway to properties on Sea Gull Creek and Crescent Lake. Prospecting was commenced on a group of 41 claims held by T. E. Noon in the vicinity of Aishihik Lake.

In the Dawson District, 427 new entries were granted as against 185 in the preceding year; in the Whitehorse District, 204 entries as compared with 36 in the previous year; and in the Mayo District, 195 new entries were granted as against 77 in the previous year. Renewals of quartz grants in the same districts were 279, 86 and 409 respectively, a total increase of 217 over the previous year.

ASSAY OFFICE

At the Assay Office maintained by the Territorial Government at Keno, 851 samples of rock were received from all parts of the Territory, and 1,179 assays or quantitative analyses were made. In addition, qualitative analyses and chemical tests were made in connection with identification and classification of various rocks and minerals of which no record was kept. The assays made were: gold and silver, 851; lead, 303; copper, 14; zinc, 10; manganese, 1.

LANDS AND TIMBER

Lands.—During the year 3 lots were sold and patented. There are now in force 10 agricultural leases; 4 grazing leases; 19 permits to occupy Dominion Lands; 24 waterfront leases; 2 miscellaneous leases, and 24 homestead entries.

The revenue from lands and Land Titles Office Fees was $8,475.25.

Timber.—The number of timber permits issued was 181, authorizing the cutting of 2,539,500 feet board measure of saw-timber and 14,379 cords of wood. Fourteen licence timber berths were in force. The total revenue amounted to $10,308.73.

In connection with the maintenance of the Alaska Highway in Yukon Territory, 24 leases of privately-owned lands were negotiated and 11 such leases were terminated during the year.

FOREST PROTECTION

The development of the Forest Protective Service in the Territory was continued. Additional equipment was received early in the season and distributed to strategic points along the Alaska Highway and the Yukon River and to Dawson and Mayo. Instruction in the use and care of the equipment was given to the Royal Canadian Mounted Police, seasonal wardens, and others. During the year, numerous inspections and patrols were made along the Alaska Highway, Haines Cut-off, Canol and access roads in Yukon Territory, a total of 19,500 miles being travelled. Suppressive action was taken on some 16 fires which burned approximately 21,000 acres during the season. Several small buildings within abandoned construction camps along the Alaska Highway were obtained for use as fire patrol cabins. Arrangements were made with the Royal Canadian Air Force, the Canadian Army, and land and air transportation companies operating in Yukon Territory whereby they would report immediately any fires observed. Permanent 60-foot radio antennae were erected at headquarters in Whitehorse and at Kluane Lake, and experiments were conducted in the use of portable two-way radio-telephones over distances extending from 25 to 150 miles.

The Officer in Charge continued to assist the Crown Timber and Lands Agent at Whitehorse in the administration of timber and public lands in southern Yukon. Activities in this connection included the locating of potential tourist camp-ground sites along the Alaska Highway, and arrangements for preliminary work on an addition to Whitehorse townsite. He also served as liaison officer for the Department in matters arising from the assumption by the Northwest Highway System of maintenance responsibilities for the Alaska Highway. The requirements and interests of the Department were presented and protected, particularly with reference to obtaining certain United States Army surplus buildings, equipment, and materials required by the various branches of the Department. Field work relating to the restoration of private property leased during construction of the Alaska Highway was continued, and a number of leases were terminated.

THE ALASKA HIGHWAY

Responsibility for maintenance of the Alaska Highway, together with access to airports along the Northwest Staging Route and flight strips bordering the highway, passed from United States authority to the Department of National Defence (Army) on April 1, 1946. The Alaska Highway and connecting roads in British Columbia and Yukon Territory are now known as the Northwest Highway System.

Airports along the Northwest Staging Route were maintained by the Royal Canadian Air Force, and flight strips bordering the highway were serviced by the Royal Canadian Engineers. The Royal Canadian Air Force also maintained the telephone and telegraph system paralleling the highway prior to turning it over to the Department of Transport for operation by Canadian National Telegraphs on April 1, 1947.

The Joint Traffic Control Board, with headquarters at Edmonton, continued to supervise travel on the highway until March, 1947, when its functions were assumed by the Department of Mines and Resources, assisted by the Royal Canadian Mounted Police, in whom responsibility for issuing travel permits was vested. An Advisory Committee consisting of representatives of the Department of Mines and Resources, the Northwest Highway System (Canadian Army), and Royal Canadian Mounted Police was formed to assist in formulating policy concerning the use of the highway. Restrictions in effect at the close of the fiscal year limited travel to persons having official business along the highway or in Alaska, bona fide prospectors, and organized hunting parties, accompanied by qualified guides. In addition, only operators of motor vehicles examined and passed as "roadworthy" were granted permits. Law and order along the highway were maintained by the Royal Canadian Mounted Police.

Bus services were operated regularly from Dawson Creek to Whitehorse and return by the British Yukon Navigation Company, and similar services were provided from Whitehorse to Fairbanks and return by O'Harra Bus Company, of Fairbanks, Alaska. Facilities for overnight accommodation of travellers were augmented by the opening of several additional stopping places, some of which provided meals and gasoline and oil service. Facilities for the maintenance and repair of motor vehicles, however, were still inadequate at the close of the year. A weekly trucking service was maintained over the highway by the British Yukon Navigation Company and, in addition, private trucking companies or individuals having legitimate business along the highway were granted permits.

The Haines Cut-Off Road connecting Haines, Alaska, with the Alaska Highway at a point approximately 100 miles west of Whitehorse, was opened for traffic during the summer of 1946. Considerable highway maintenance and bridge repair were necessary before the road was opened. The road was closed to traffic for the winter.

Engineers of the Engineering and Construction Service of the Department of Mines and Resources, who were located at Whitehorse, Y.T., and Fort Nelson, B.C., continued to make regular inspections of the highway, and furnished detailed reports describing its condition.

THE CANOL PROJECT

The petroleum-distributing pipelines from Skagway to Whitehorse and from Whitehorse to Fairbanks, which were constructed as part of the Canol Project, were placed on an inoperative and stand-by condition during the year by the United States Government. Crude oil facilities, including the pipeline from Norman Wells to Whitehorse and the refinery at Whitehorse, were offered for sale by tender during the latter part of the fiscal year by the United States

Foreign Liquidation Commission. The date set for the closing of tenders was April 21, 1947. The service road paralleling the Canol pipeline from Johnson's Crossing to Norman Wells remained closed owing to washouts and lack of maintenance.

ROADS, BRIDGES AND PUBLIC WORKS

Expenditures on Territorial roads, bridges, and public works, including the purchase of equipment, amounted to $286,376.67. Landing fields for aircraft at Dawson and Mayo were maintained in good condition throughout the year despite the unusual severity of the winter.

During the year, officers of the Department of Transport made a survey of the air route from Whitehorse to Mayo and Dawson, the funds for which were provided by the Department of Mines and Resources. The purpose of the survey was to determine the feasibility of improving landing fields in use, select sites for alternate fields, and estimate the cost of improvement or new construction. Among the landing fields examined were those at Dawson, Mayo, Fort Selkirk, McQuesten, Minto, Yukon Crossing, Braeburn, and Carmacks. The construction of new emergency landing strips at Braeburn and Minto was recommended as a result of the survey.

AGRICULTURE

Further progress was made by the Experimental Farms Service of the Department of Agriculture in establishing an agricultural substation at Pine Creek on the Alaska Highway, about 100 miles west of Whitehorse. Field tests were conducted in the summer of 1946 on land prepared in 1945. Approximately seven acres were devoted to cereal and forage trials and five acres to oats and barley. Samples from most cereal plots were later submitted to the Cereal Division, Central Experimental Farm, Ottawa, for appraisal, and the results obtained were generally satisfactory. During early summer, a virgin area of approximately 10 acres was brushed, plowed, and worked down for additional cropping in 1947, bringing to 30 acres the area available for this purpose. A new greenhouse was completed during the year.

In addition, garden trials of a fairly full range of common vegetables were undertaken, transplantation of tomatoes, cabbages, cauliflower, peppers, and cucumbers being made from flats developed in a greenhouse. The garden trials proved extremely encouraging, the common vegetables responding well. The tomatoes and cucumbers, however, were cut down by a light mid-summer frost.

It is planned to establish both cattle and poultry at the station in 1947, provided adequate buildings can be erected.

During the month of August, the Superintendent of the substation, J. W. Abbott, made a combined contact and inspection trip down the Yukon River system. Local pioneer agriculturists were visited and interviewed at various locations, and plots containing cereal and forage seed furnished by the substation were examined. Encouraging results were revealed. Mr. Abbott acted as judge of a vegetable and small fruit display at Dawson on August 17, the anniversary of "Discovery Day" (1896).

In the northern part of the Territory the season was drier than usual, but notwithstanding this condition, garden crops, with the exception of potatoes, were exceptionally good in the Dawson area.

FUR AND GAME

Collections made under the Fur Export Tax Ordinance amounted to $8,921.29, a decrease of $1,697.20 from the previous year. An increase in the number of cross fox, lynx, muskrat, and coyote pelts taken was reported. The

number of coyote pelts presented for tax was 40 as compared with 37 the previous year, and the number of wolf pelts 49, as compared with 63 the previous year. Revenue from Game Ordinance licences was $11,613, an increase of $6,203 from the previous year. Bounty payments for wolves and coyotes totalled $11,130.

PUBLIC WELFARE

The health of the white population in the Territory was remarkably good during the year, Medical Health Officers in the various districts reporting a very low incidence of communicable diseases. However, an increase in tuberculosis among Indians was reported. The Venereal Disease Ordinance appeared to be functioning efficiently, and the incidence of venereal disease diminished greatly.

Registrations under the Vital Statistics Ordinance during the year were 225 births, 65 marriages, and 94 deaths. The Government hospital at Whitehorse and St. Mary's Hospital at Dawson were operated throughout the year. Grants toward their maintenance were provided by Council as follows: Whitehorse, $25,000; Dawson, $72,000. Hospital days for patients during the year were: Whitehorse, 9,221 for 700 patients; Dawson, 18,645 for 610 patients. Hospital days for indigent patients were: Whitehorse, a few days for 8 patients; Dawson, 11,329 days for 76 patients. A public nurse was employed in Mayo District for the full year. Increased activity in the Mayo Mining District necessitated the re-conditioning of the Mayo General Hospital, and during the year the building was repaired and orders were placed for a considerable amount of new equipment. Much difficulty was experienced in obtaining supplies, but at the end of the year it was expected that the hospital would be functioning within a few weeks.

The sum of $40,943.15 was expended for relief. A total of $4,721.49 was paid to St. Paul's Hostel, Dawson, for the care of all indigent half-breed and white children who attended the Dawson Public School.

EDUCATION

Seven schools were maintained in the Territory during the year, including two at Dawson and one each at Whitehorse, Mayo, Carcross, Brook's Brook, and Destruction Bay, the two last-named being located on the Alaska Highway. The total number of pupils enrolled during the school year ended June 30, 1946, was 385, and the total number of pupils enrolled as of March 31, 1947, was 432. The number of teachers employed was 14. The total amount expended on schools and education was $71,860.61.

LAW AND ORDER

Law and order were well maintained throughout the Territory by the Royal Canadian Mounted Police.

SCIENTIFIC SURVEYS

Scientific surveys in various fields were undertaken or continued by officers of the Department. A location survey for a road between Jake's Corner, on the Alaska Highway, and Atlin, B.C., was made by the Surveys and Engineering Branch, and plans, profiles, and cost estimates were prepared. A reconnaissance survey and a preliminary estimate of cost were also made of the Whitehorse-Mayo section of the proposed road from Whitehorse to Dawson. Triangulation work, commenced at Whitehorse in 1945, was continued by the Geodetic Service along the Alaska Highway, and by the end of the season had been completed as far as the British Columbia-Yukon boundary south of Teslin village. Levelling between Edmonton and Whitehorse was continued, and the year's work brought to completion a line of precise levels 1,400 miles in length between these places. The legal survey along the Alaska Highway was extended from Whitehorse to a point about 25 miles northwest of Burwash Landing, a distance of 200 miles. Gauging stations were maintained by the Dominion Water and Power Bureau on the important streams along the Alaska Highway, and provided a continuous record from which available water power resources were calculated. An engineer of the Engineering and Construction Service, stationed at Whitehorse, acted as a Departmental observer on the Alaska Highway, and made periodic reports on all phases of maintenance and reconstruction. The Canadian and United States Commissioners of the International Boundary Commission made a joint inspection of various points on the Yukon-Alaska boundary, particularly in the area where this boundary is crossed by the Alaska Highway. A survey party also cleared sections of the boundary near the Alaska Highway.

Geological investigation was continued in the Territory during the year by three parties of the Geological Survey of Canada. One party commenced a revision and more thorough study of the Whitehorse area, formerly a source of copper ore. Geological work was also continued in the McQuesten area between Mayo and Dawson, and commenced in the Dezadeash area west of Whitehorse. A party from the National Museum of Canada continued archaeological investigations in northwestern Yukon, with a view to tracing the migration routes from Siberia of the aboriginal inhabitants of North America.

LAND REGISTRY

The Land Registry deals chiefly with lands remaining under the control of the Dominion. A Central Office of Record is maintained in which lands controlled by other departments are listed and certain Ordnance and Admiralty Lands are administered, as well as Dominion Public Lands, Soldier Settlement charged lands, and lands which were reserved to the Dominion when the natural resources were transferred to the Western Provinces. Accounts of advances for seed grain, fodder, and relief made to settlers in the Western Provinces are kept in the Land Registry, which, in conjunction with the Provinces, deals with applications for the adjustment or apportionment of these accounts. The Land Registry issues Letters Patent, administers matters connected with the purchase of lands acquired for the Alaska Highway, and also administers the mineral rights reserved by virtue of Section 57 of the Soldier Settlement Act.

The Land Registry lost two of its senior members during the year in review. J. Lorne Turner, Registrar of Lands, died in July, 1946, and A. R. Chevrier, who had charge of seed grain work, passed away in March, 1947. These men gave many years of outstanding service to the Department.

During the year a number of veterans of the recent war were taken on the staff.

CENTRAL OFFICE OF RECORD

The Central Office of Record maintained by the Land Registry receives many requests from other Government departments and the general public for information regarding the ownership of particular parcels of land. At present the Central Office has 6,636 parcels listed, and this number is being increased by the addition of land acquired during the war years.

ORDNANCE AND ADMIRALTY LANDS

The Ordnance and Admiralty Lands are areas in the Maritime Provinces, Quebec, and Ontario which were, because of their strategic situation, reserved or acquired by the Crown. They were transferred to this Department to be administered, and have been made revenue producing whenever possible by being placed under lease. During the year a portion of the Levis Military Reserve was transferred to Land Registry control; thirty-eight sales of Ordnance Lands were completed to private individuals, corporations, and provincial governments; two areas in the Clayoquot district were transferred to the Province of British Columbia; fifteen investigations of lands in New Brunswick, Quebec, Ontario, and British Columbia were carried out; surveys were made of lands in New Brunswick, Quebec, Alberta, and British Columbia, and eighty-six leases and two permits were issued. The net revenue from Ordnance and Admiralty Lands in rentals, sales, and assignment fees was $23,408.90.

PUBLIC LANDS

Lands, controlled by other departments and no longer required for the purpose for which they are obtained, are transferred to the Land Registry for administration and disposal. One parcel of these lands was sold during the year to the Government of the Province of Prince Edward Island, and seven areas were sold to corporations and private individuals. Nine inspections of Public Lands in Quebec, Ontario, Alberta, and British Columbia were made. The net revenue, consisting principally of rentals, fees, and land sales, amounted to $43,571.06.

SOLDIER SETTLEMENT CHARGED LANDS

Lands in the four Western Provinces against which charges under the Soldier Settlement Act are registered remain vested in the Dominion. There are eighty-six quarter-sections remaining, comprising approximately 13,500 acres, divided as follows: Manitoba, 1,120 acres; Saskatchewan, 6,460 acres; Alberta, 5,440 acres; British Columbia, 480 acres. Crown Grants are issued to settlers who complete their duties in accordance with the terms of the Dominion Lands Act, if their indebtedness to the Soldier Settlement has been liquidated. If the indebtedness is still unpaid when the duties are completed, or if the entrant on the land desires this action to be taken, patent may be issued in the name of the Director of Soldier Settlement. During the year nine patents were issued, one in the name of the Director of Soldier Settlement of Canada and eight in the name of the various entrants.

TIMBER AND GRAZING WITHIN THE PROVINCES

Timber.—Within the boundaries of the National Parks there are eleven licence timber berths covering a total area of 61·212 square miles. Two are in Manitoba and nine in British Columbia. Licences, in duplicate, were issued for each berth. The year's revenue amounted to $2,923.11.

One timber permit berth is in force on the Dominion Government Coal Block near Hosmer, B.C. The revenue collected during the year was $288.81.

Throughout the year timber cutting operations were carried on at Ordnance Reserve No. 1 and Naval Reserve A on St. Joseph Island in Lake Huron. The revenue amounted to $283.35.

Grazing.—In southern Saskatchewan annual grazing permits were issued on Dominion Lands covering a total area of 9,916 acres and sworn returns by the permittees indicated that for the grazing season 1946 there were 560 cattle and 106 horses on the lands. The revenue collected, consisting of ground rental, amounted to $172.64.

SEED GRAIN, FODDER, AND RELIEF INDEBTEDNESS

During the year, recommendations relating to the adjustment or apportionment of outstanding seed grain, fodder, and relief indebtedness were submitted in 1,560 cases by the Alberta, Saskatchewan, and Manitoba Adjustment Boards.

These recommendations were ratified by Orders in Council and 2,012 discharges and releases of liens were issued. As a result of indebtedness amounting to $202,433.40 was written off. A total of 2,721 inquiries was received from the provinces for statements of outstanding indebtedness relative to the issue of land grants, and 210 certificates of indebtedness were issued. In addition, 5,460 inquiries were received from Debt Adjustment Boards in the Western Provinces. Gross collections for the fiscal year amounted to $85,125.67. The sum of $3,069.04 was refunded, leaving a net revenue of $82,056.63.

As the staff engaged in this work has other responsibilities as well, it is impossible to give a definite figure for the cost of administration, but the total amount, including office expenses and field investigations, is approximately $7,000.

The following summary shows the financial operations for the year ended March 31, 1947:

	Principal	Interest	Total
Debits—			
Balance outstanding March 31, 1946	$2,406,911 55	$3,577,336 66	$5,984,248 21
Accrued interest April 1, 1946, to March 31, 1947		137,726 21	137,726 21
Total debits	$2,406,911 55	$3,715,062 87	$6,121,974 42
Credits—			
Net revenue, April 1, 1946, to March 31, 1947	56,418 88	25,637 75	82,056 63
Amount written off as loss by Orders in Council— (Sec. 1 Chap. 51, 17 George V.)	54,648 82	147,784 58	202,433 40
Total credits	$ 111,067 70	$ 173,422 33	$ 284,490 03
Amount outstanding March 31, 1947	$2,295,843 85	$3,541,640 54	$5,837,484 39

SUMMARY

PROVINCE OF MANITOBA

	Principal	Interest	Total
Debits—			
Amount outstanding March 31, 1946	$ 10,559 53	$ 17,044 30	$ 27,603 83
Accrued interest April 1, 1946, to March 31, 1947		555 21	555 21
Total debits	$ 10,559 53	$ 17,599 51	$ 28,159 04
Credits—			
Net revenue April 1946, to March 31, 1947	$ 377 62	$ 129 81	$ 507 43
Amount written off as loss by Orders in Council	144 80	931 79	1,076 59
Total credits	$ 522 42	$ 1,061 60	$ 1,584 02
Amount outstanding March 31, 1947	$ 10,037 11	$ 16,537 91	$ 26,575 02

SUMMARY

PROVINCE OF SASKATCHEWAN

	Principal	Interest	Total
Debits—			
Amount outstanding March 31, 1946	$1,562,705 26	$2,273,824 89	$3,836,530 15
Accrued interest April 1, 1946, to March 31, 1947		89,092 24	89,092 24
Total debits	$1,562,705 26	$2,362,917 13	$3,925,622 39
Credits—			
Net revenue April 1, 1946, to March 31, 1947	$ 46,543 27	$ 22,437 15	$ 68,980 42
Amount written off as loss by Orders in Council	14,756 19	66,731 89	81,488 08
Total credits	$ 61,299 46	$ 89,169 04	$ 150,468 50
Amount outstanding March 31, 1947	$1,501,405 80	$2,273,748 09	$3,775,153 89

SUMMARY

PROVINCE OF ALBERTA

	Principal	Interest	Total
Debits—			
Amount outstanding March 31, 1946	$ 833,621 76	$1,286,427 47	$2,120,049 23
Accrued interest April 1 1946, to March 31, 1947		48,078 76	48,078 76
Total debits	$ 833,621 76	$1,334,506 23	$2,168,127 99
Credits—			
Net revenue April 1, 1946, to March 31, 1947	$ 9,497 99	$ 3,070 79	$ 12,568 78
Amount written off as loss by Orders in Council	$ 39,747 83	$ 80,120 90	$ 119,868 73
Total credits	$ 49,245 82	$ 83,191 69	$ 132,437 51
Amount outstanding March 31, 1947	$ 784,375 94	$1,251,314 54	$2,035,690 48

SUMMARY

PROVINCE OF BRITISH COLUMBIA

Amount outstanding March 31, 1947	$ 25 00	$ 40 00	$ 65 00

LETTERS PATENT

During the fiscal year there were 46 Letters Patent issued covering a total of 2,959 acres, divided according to provinces as follows:

	Patents	Acres
Manitoba	4	647
Saskatchewan	10	1,490
Alberta	6	693
Northwest Territories	23	121
Yukon Territory	3	8
	46	2,959

The various kinds of grants are dealt with in the following table:—

—	*Homesteads		*Soldier Grants		†Special Grants		Sales	
	Patents	Acres	Patents	Acres	Patents	Acres	Patents	Acres
Manitoba	3	487	1	160	......	......		
Saskatchewan	5	719	4	612	1	159	......	......
Alberta	2	320	3	369	......	......	1	4
Northwest Territories	......	......	......	......	......	......	23	121
Yukon Territory	......	......	......	......	......	......	3	8
Totals	10	1,526	8	1,141	1	159	27	133

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* Under this heading are included lands entered for by returned soldiers, affected by loans from the Director of Soldier Settlement of Canada, said loans having been repaid in full. Patents were issued direct to the settlers.

† Under this heading is included land entered for by a returned soldier affected by a loan from the Director of Soldier Settlement of Canada, which land was patented to the said Director at the request of the entrant under the Soldier Settlement Act.

There were 227 certified copies of Letters Patent issued during the fiscal year, for which the Department received $700.

ALASKA HIGHWAY LAND ACQUISITION

In connection with the acquisition of land for the right-of-way of the Alaska Highway, title for seven parcels has been secured. The remaining seven are in the hands of the Department of Justice. Negotiations in connection with camp-sites and flight strips have been completed in six cases, and the remaining one, in which expropriation proceedings were necessary, is in the hands of the Department of Justice. Easements have been secured covering three parcels on the water line to Dawson Creek. Crown Grant has not been completed in three cases, while the fourth has been expropriated through the Department of Justice. Of a total of nine easements required on the water line to Fort St. John, seven have been secured; the remaining two are now in the hands of the Department of Justice pending the settlement of the estates of the original owners of the property. All telephone and telegraph easements have been completed both in Alberta and British Columbia, with the exception of two which have been delayed due to the absence of the property owners. These are now in hand.

NATIONAL PARKS BUREAU

There are eighteen National Parks and nine National Historic Parks established across the Dominion, with each of the provinces having one or more of them within its boundaries. These parks are administered under the National Parks Act, the authority and provisions of which also cover the many National Historic Sites and Monuments set aside in all parts of Canada to perpetuate leading men and events in national history. Besides the controlling staff at Ottawa, a resident superintendent is located in each of the principal parks and is assisted by a capable staff in the handling of his administrative duties. A scientific service is maintained in the National Parks Bureau to advise on wildlife problems and to administer the Migratory Birds Convention Act.

It is proposed to abolish Buffalo Park and Nemiskam Park in Alberta and to withdraw certain parcels of land from Waterton Lakes Park in Alberta, Prince Albert Park in Saskatchewan, and Riding Mountain Park in Manitoba. At the same time it is proposed to add to Fort Beausejour Historic Park, New Brunswick, three small tracts of land containing important historical features, to attach a section of land to Riding Mountain Park in exchange for another section to be withdrawn, and to add 23·6 square miles of pasture land to Elk Island Park in order to provide sufficient range to guarantee the preservation in a healthy condition of the herd of buffalo located there.

TRAVEL TO THE PARKS

During the fiscal year 1946-47 the National Parks resumed their normal rôle as outstanding tourist attractions and made a major contribution to the well-being and morale of the many Canadians who visited these areas, dedicated to them for their benefit, education, and enjoyment.

The considerable increase in the number of visitors to the parks which became so evident with the termination of hostilities in World War II during the preceding year was continued during the period under review. The attendance figure reached pre-war levels, and was only slightly less than the record established in 1940. Of the 992,745 visitors recorded, nearly 210,000, or approximately twenty-one per cent, came from outside Canada, mostly from the United States.

The number of visitors to each park and a comparison with the tabulation of the previous year are given in the following table:

National Parks

—	1946-47	1945-46	Increase
Banff	246,397	148,113	98,284
Cape Breton Highlands	23,896	18,863	5,033
Elk Island	39,976	24,939	15,037
Georgian Bay Islands	6,591	3,842	2,749
Glacier	461	330	131
Jasper	29,191	16,127	13,064
Kootenay	64,530	28,326	36,204
Mount Revelstoke	8,542	6,474	2,068
Point Pelee	87,150	59,948	27,202
Prince Albert	31,474	18,858	12,616
Prince Edward Island	50,281	48,068	2,213
Riding Mountain	161,237	108,060	53,177
St. Lawrence Islands	15,824	10,809	5,015
Waterton Lakes	126,337	46,744	79,593
Yoho	23,015	10,868	12,147

National Historic Parks

Fort Anne	8,754	5,544	3,210
Fort Beausejour	12,023	5,343	6,680
Fort Chambly	22,546	16,203	6,343
Fort Lennox	1,223	655	568
Fortress of Louisbourg	4,238	3,126	1,112
For tMalden	17,335	15,279	2,056
Fort Wellington	5,699	2,594	3,105
Port Royal Habitation	6,025	3,296	2,729
Totals	992,745	602,409	390,336

Among the many distinguished visitors to the National Parks during the year were Their Excellencies, the Governor General of Canada and Viscountess Alexander of Tunis, who visited Banff and Jasper Parks, and Field Marshal Montgomery, who visited Jasper Park.

DIRECT REVENUE

The net revenues from the National Parks Services and from the administration of the Migratory Birds Convention Act for the fiscal year 1946-47 amounted to $422,219.91 and $1,229.50, respectively, totalling $423,449.41, an increase of approximately 37·6 per cent over the total of $307,831.06 for the preceding year.

CONSERVATION SERVICES

Forest Protection

Every possible effort was made to maintain and increase the efficiency of the fire-fighting organization in all phases, including personnel, fire-detection and suppression, transportation, and communication. Improvement work was affected adversely by the prevailing shortages in labour, materials, and new equipment, so that no new fire lookouts were completed during the year. A considerable amount of preliminary work was done toward the establishment of the Geraldine lookout in Jasper Park and the Aylmer lookout in Banff Park, however, and it was expected that both would be completed in 1947. Panoramic infra-red photographs were completed for most of the lookouts in both Banff and Jasper Parks to assist the lookout men in describing more accurately the location of fires which come under their observation.

New fire-fighting equipment, including twelve portable gasoline pumps, one booster pump, and 21,500 feet of hose, was purchased to replace articles worn out during the war years.

FIRE WEATHER STATIONS

Stations which take readings several times a day of factors affecting the rate of spread of forest fires, such as wind velocity, temperature, precipitation, relative humidity, and rate of evaporation, were in continuous operation from early in May until the end of September in Banff, Jasper, Yoho, Waterton Lakes, Prince Albert, and Riding Mountain Parks. These stations maintain charts showing the fire hazard conditions at stated times throughout the day and make short range forecasts of weather conditions likely to occur, in order to guide the responsible officers in disposing their staffs, crews, and equipment. They also co-operate with the Meteorological Service of the Department of Transport, wiring certain weather data every day and receiving in return daily forecasts to supplement their information and charts.

FIRE LOSSES IN NATIONAL PARKS

During the year 1945 a record was established for the small number of forest fires started and the small extent of the areas burned. This reflected not only the very efficient services of the fire-fighting and prevention organizations, but a very favourable fire-hazard condition. During the latter part of May and early in June, and again during July and August, 1946, extremely hazardous forest fire conditions prevailed. This situation resulted in forty-nine fires being reported, compared with nineteen during the preceding year. However, due to the promptness with which they were reported and the efficient action taken in extinguishing them, they were mostly confined to spot fires, or those of small dimensions.

The number of forest fires in each park, the areas burned, the costs of suppression, and a comparison with the figures of the preceding year are given in the following table:

Park	Number of Fires		Area Burned Acres		Cost of Suppression	
	1946	1945	1946	1945	1946	1945
					$ cts.	$ cts.
Banff	19	4	2	2¼	396 05	69 52
Jasper	7	1	248	9½	2,137 46	4 25
Glacier	1	2	2½	131	206 30	351 92
Kootenay	3	3	161	4½	440 58	132 67
Yoho	9	0	1½	0	304 18	0 00
Mount Revelstoke	0	3	0	1¾	0 00	483 28
Waterton Lakes	4	2	Spot	Spot	4 30	2 50
Elk Island	1	1	1,120	Spot	408 11	5 00
Prince Albert	2	2	177	½	55 13	70 00
Riding Mountain	1	0	65	0	5 34	0 00
St. Lawrence Islands	0	0	0	0	0 00	0 00
Point Pelee	1	0	Spot	0	0 00	0 00
Georgian Bay	0	0	0	0	0 00	0 00
Cape Breton	0	1	0	4	0 00	142 77
Prince Edward Island	1	0	Spot	0	0 90	0 00
Total	49	19	1,777	153½	3,958 35	1,261 91

An analysis of the causes of these fires shows that lightning was responsible for 32·6 per cent of the total; smokers 24·4 per cent; campers 14·2 per cent, and miscellaneous known causes 12·1 per cent, and that the remaining 16·7 per cent were attributable to settlers, the railways, or to causes unknown.

INSECT CONTROL

An infestation of bark beetle (dendroctonus monticolae) similar to earlier outbreaks which had constituted a serious threat to other large tracts of pure lodgepole stands in the western parks, was discovered in a stand of lodgepole pine (pinus contorta) near Leanchoil in Yoho Park. These attacks had been successfully controlled in Banff and Kootenay Parks by the standard method of cutting and burning the infested trees during the winter months, and it was decided to use the same method to control the infestation in the Leanchoil area.

Due to the scarcity of labour, this work during the winter of 1945-46 was limited to January, February, and March. The operation was resumed in October, 1946, but the labour situation proved even more difficult, particularly as to the type of labour then available. As a result, the costs of the operation became excessive and with the exhaustion of the appropriation the camp was closed in December, 1946. The infestation continues to be active and further control work is planned for 1947.

DISPOSAL OF TIMBER UNDER ANNUAL CUTTING BUDGET

Disposal of saw-timber, fuel-wood, and other forest products to local settlers under the annual cutting budget was continued in Riding Mountain Park. In comparison with that of 1945-46 this year's cut showed a considerable increase in saw-timber, principally in hardwood, the cut of coniferous species remaining well within the limit allowed under the working plan. During the current year 2,103 permits were issued for 3,788,250 feet board measure saw-timber, 19,605 cords of fuel-wood, 69,832 posts, and 12,017 trees.

WILDLIFE MANAGEMENT

Studies of animal populations, disease, and range conditions for big game in the National Parks were continued. Capt. A. W. F. Banfield, Parks Mammalogist, conducted investigations in the mountain parks during the summer of 1946, and began studies of predation and range conditions in Prince Albert Park and Cape Breton Highlands Park during the winter of 1946-47. Dr. Ian McTaggart Cowan, of the University of British Columbia, continued winter range studies in the mountain parks. Wildlife, including big game species, was found to be in fairly good condition. Because of continued serious overgrazing in Banff and Jasper Parks, large numbers of surplus elk were removed. The dressed meat and hides were given to the Indian Affairs Branch for distribution to Indian reservations. Investigations in 1947 will show whether the reduction of elk has been adequate to prevent further destruction of range.

Owing to threatened depletion of food supply and damage to certain scenic locations, it was necessary to trap a number of beaver alive in Jasper, Banff, and Waterton Lakes Parks. Fifty-seven animals were donated to the Indian Affairs Branch for liberation on Indian trapping areas elsewhere in Alberta. No marten were live-trapped during the year.

Some control of predators was effected in certain National Parks, especially on park borders in the vicinity of cultivated and stock-raising areas.

WILD ANIMAL PARKS

In order to avoid damage to the range in Elk Island Park by over-use, it was necessary to slaughter 200 elk and 66 buffalo. The meat and hides of the elk were donated to the Indian Affairs Branch for distribution to the Indians. Sixty-two buffalo hides and the meat of 53 buffalo were sold by tender. The meat of 13 buffalo was set aside for Banff Indian Days in 1947 and for other special purposes. Thirty-two buffalo were slaughtered at Riding Mountain Park as part of a program to ensure maintenance of a moderate-sized, healthy herd. The meat and hides of these buffalo were sold by tender. Two buffalo were slaughtered at Prince Albert Park to protect the allotted range from over-use. The meat was given to the Indian Affairs Branch and the hides were sold by tender.

Three hundred and seventy-five surplus elk were slaughtered in Jasper Park because of the serious condition of over-population of elk and in order to preserve and restore the natural ranges, which were becoming seriously over-grazed. The dressed meat and hides were donated to the Indian Affairs Branch.

For similar reasons, 321 surplus elk were slaughtered in Banff Park. The hides and dressed meat were donated to the Indian Affairs Branch.

A census of wild animals in fenced enclosures in National Parks as of March 31, 1947, is as follows:

Species	Banff Park Paddock	Elk Island Park	Prince Albert Park Paddock	Riding Mountain Park Paddock	Total
Buffalo	9	1,019	6	22	1,056
Elk	....	552	....	168	720
Moose	....	390	....	....	390
Mule deer	....	96	....	1	97
White-tailed deer	....	....	....	15	15
Rocky Mountain goat	1	....	....	....	1
Rocky Mountain sheep	1	....	....	....	1
Total	11	2,057	6	206	2,280

FISHING AND FISH CULTURE

Fishing in the National Parks of Canada was reported good by the majority of experienced anglers, and fine catches of all game species were reported in the creel census.

In addition to the six parks in which creel census data have been collected for several years, Prince Edward Island Park, Riding Mountain Park, and Cape Breton Highlands Park have commenced similar operations. Increased co-operation in the return of the census cards was received from the anglers during the past year. Cards completed for use in fisheries research totalled 2,068.

During the summer of 1946 Dr. V. E. F. Solman, Parks Limnologist, carried out studies in nine western parks. These investigations produced data for guidance in the development of park policies of fish management, for improvement of the angling, and for more efficient utilization of hatchery products.

General conditions in Banff Park seemed to have improved in all waters, except for lake trout fishing in Lake Minnewanka. The Third Vermilion Lake was overfished. The Engineering and Construction Service carried out experiments with the use of Bow River water at the Banff hatchery. The Bow River water was found to be warmer and therefore more suitable than the present supply, with the exception that heavy silting takes place during warm weather.

In Cape Breton Highlands Park, extremely dry weather and low water in all streams throughout the fishing season were believed responsible for unusually small catches. Good catches of trout were reported from the Clyburn, North Aspy, and MacKenzie Rivers, and some sixty salmon were reported taken in the Cheticamp River. Plans have been made to carry out a limnological investigation of the waters in this park.

Fishing in the streams of Glacier Park was generally poor throughout the season.

Fishing in Jasper Park was "spotty", although it was the opinion of anglers that plenty of fish were present. Weather conditions probably affected the angling, and it is known that many inexperienced anglers were fishing during the season.

From the Jasper hatchery 121,000 rainbow trout eggs and 54,600 Eastern brook trout eggs were transferred to Banff Park, and 100,000 rainbow eggs to Waterton Lakes. Sixty thousand rainbow fingerlings were also forwarded to Banff Park.

Angling was poor throughout the season in Kootenay Park, due to unusually high water in the early summer, and consequent muddiness.

Fishing was good in Mount Revelstoke Park, and favourable reports were received of the fishing in Millar Lake, Eva Lake, and Lake of Jade.

The quality of the angling in Prince Albert Park was generally better than last year. Good catches of pickerel, pike, and bass were reported from Waskesiu, Crean, and Heart Lakes. A noticeable increase of fishermen visited Kingsmere Lake, and good catches of lake trout were taken in the early part of the season. Netting of whitefish in Waskesiu Lake was again permitted to a limited extent during the summer, for local use only.

During 1946 fishing conditions in Prince Edward Island Park were generally poor, although some very good trout were taken from the Lake of Shining Waters, and Long Pond. A limnological investigation of the waters is planned for 1947.

Fishing in the lakes in Riding Mountain Park showed some improvement over past years, no doubt due to the higher lake levels. Another shipment of approximately 328 mature lake trout was made from Clearwater Lake, north of The Pas, to Clear Lake.

Angling in Waterton Lakes Park was fairly good. There were good catches of lake trout from Waterton Lake and very good catches of eastern brook trout from Cameron Lake early in the season; excellent catches of trout were made from Lineham Lake.

In Yoho Park the fishing in the lakes and streams was generally poor throughout the season except in Lake O'Hara, where several good catches were reported.

The following statement shows the number of fry, fingerlings, and adult fish distributed in park waters during the year:

Park	Rainbow Trout	Cutthroat Trout	Speckled Trout	Lake Trout (adult)	Total
Banff	278,000	120,000	72,000	....	470,000
Jasper	127,350	....	33,190	....	160,540
Kootenay	30,000	40,000	....	....	70,000
Waterton Lakes	69,875	73,900	....	....	143,775
Yoho	15,000	....	....	....	15,000
Riding Mountain	....	....	....	328	328
Total	520,225	233,900	105,190	328	859,643

PROVINCIAL-DOMINION WILDLIFE CONFERENCE

The Eleventh Provincial-Dominion Wildlife Conference was held in Ottawa February 27 and 28, 1947. This conference of Provincial and Dominion officials who co-operate in the conservation of Canadian wildlife resources is of great value in the promotion of scientific research and the solution of administrative problems. The United States Fish and Wildlife Service was well represented.

Resolutions were adopted relating to the following subjects: increased protection for North American waterfowl; stimulation of wildlife research in Canada; uniformity in restrictions on firearms; establishment of courses in wildlife management in Canadian universities; uniform fur royalty schedule; the importation of scientific publications into Canada; safeguarding of biological resources in international, interprovincial, and provincial waters where alterations in waterways and water areas are proposed; investigation of the status of barren ground caribou; establishment of a "Wildlife Conservation Week"; adequate control of the use of aircraft for transporting hunters and tourists into remote areas; and investigation of crop damage by sandhill cranes in parts of Canada.

MIGRATORY BIRDS CONVENTION ACT

The Migratory Birds Treaty, which was signed in Washington, D.C., on August 16, 1916, and made effective by Act of Parliament of Canada, 1917 (Chapter 130, Revised Statutes of Canada, 1927, and Amendments), was designed for the better protection of certain birds that migrate between Canada and the United States. In this conservation measure the Dominion and the provinces co-operate. Regulations in accordance with the Statute are agreed upon and are made effective by both the Dominion and the provinces.

Under the Migratory Birds Convention Act there are reserved in Canada, under federal control, bird sanctuaries covering a total area estimated at 1,356 square miles.

The Ontario Provincial Hannah Bay Waterfowl Sanctuary was established a bird sanctuary under the Migratory Birds Convention Act, and was included in the Federal Hannah Bay Bird Sanctuary (N.W.T.), during the period under review.

During the year, 1,095 permits and licences were issued. Distributed printed material comprised 5,251 copies of the Migratory Birds Convention Act and Regulations, 14,551 Abstracts of the Regulations, 41,558 posters, and 6,629 educational pamphlets.

Field administration of the Act was continued under the supervision of four district officers. The title of these positions has been changed from Chief Federal Migratory Bird Officer to Dominion Wildlife Officer. Throughout the year, the Dominion wildlife officers conducted investigations of the waterfowl situation. They supervised, in their respective districts, a special inventory of wintering waterfowl. This was the first year in which Canada participated in this census, which is continental in scope.

The Dominion Wildlife Officer for British Columbia conducted special investigations on wildlife in the Cariboo and Vanderhoof regions, and at Sixteen Mile Lake, Frances Lake, and Lakelee Lake. He also investigated various waterfowl habitat improvement projects, and studied the problem of oil pollution in coastal waters.

The Dominion Wildlife Officer for the Prairie Provinces investigated waterfowl conditions at various P.F.R.A. projects, carried out joint inspections of certain bird sanctuaries with provincial authorities, made special investigations of wildlife in Prince Albert and Riding Mountain National Parks, and engaged in varied field research.

The Dominion Wildlife Officer for Ontario and Quebec patrolled and inspected the ten bird sanctuaries on the north shore of the Gulf of St. Lawrence, and added to the coloured motion picture of this region which was begun in the previous year. Special studies were made in Point Pelee National Park, and in other areas, in co-operation with the provinces. An investigation of the blue goose situation in James Bay was begun, and will be continued.

The Dominion Wildlife Officer for the Maritime Provinces made studies of woodcock populations, the waterfowl situation, and condition of the eelgrass.

Officers of the Bureau delivered many illustrated lectures during the year, and in other ways disseminated information relating to migratory birds and their conservation.

In 1946, the general waterfowl population throughout Canada showed a considerable decrease, due, it is believed, to a poor nesting season and increased hunting pressure. This situation led to shortened seasons and other increased restrictions on waterfowl hunting.

As of December 31, 1946, the official Canadian bird-banding records contained 497,482 records of birds that had been banded, and a total of 33,406 detailed records of recovery of birds that carried bands.

Persons who recover birds wearing official bands are urged to further the success of bird-banding by reporting the details. No postage is required on reports related to banded birds if they are directed to the Controller, National Parks Bureau, Ottawa, Canada.

The Bureau was represented at the Sixty-fourth Meeting of the American Ornithologists' Union in Urbana-Champaign, Illinois, September 2-6, 1946; the Twelfth North American Wildlife Conference in San Antonio, Texas, February 3-5, 1947; and the annual meeting of The International Association of Game, Fish, and Conservation Commissioners in St. Paul, Minnesota, September 9-11, 1946. Two papers were presented at the latter two meetings—one on wildlife conditions in Canada and one on the Canadian waterfowl situation.

MAINTENANCE AND IMPROVEMENTS

Due to the prior national need of homes and the shortages in labour, materials, and equipment, no new work or improvement of major importance was undertaken in the National Parks during the year. However, all facilities such as highways, roads, bridges, trails, telephone lines, buildings, and municipal services were maintained in a state of efficient operation.

ROADS AND BRIDGES

The work done under this heading consisted of repairs to road grades, surfaces, bridges, and culverts in order to keep them in good condition for traffic. In Banff Park work was done on the Eldon revision, preparing the subgrade for asphalt paving; a new road into the rock quarry was commenced, and 700 feet of new road was built from Calgary Highway to Bungalow Camp "A". Four miles of fire road was built to extend the Cascade fire road toward Flint's Park, and 8 miles of the Healey Creek fire road was improved. In Yoho Park a new steel bridge over the Kicking Horse River at Leanchoil was completed, and in Prince Edward Island Park a half mile of secondary road was built. In Cape Breton Highlands, a new road was made from near Mile 8 on the main highway into Warren Lake, as well as a short road from the athletic field to the Keltic Lodge road.

TRAILS

In Banff Park, 3½ miles of trail was rebuilt and 2 miles of new horse trail was constructed, while in Jasper Park 2 miles of fire trail was constructed at Mile 9 of the Medicine Lake River road.

COMMUNICATION SYSTEMS

No new construction work was carried out on telephone systems in the National Parks except in Jasper, where one mile of forest line was constructed along the East Highway, Mile 17 to 18. All telephone lines in the various parks were maintained in good working order, and in Banff and Cape Breton Highlands considerable equipment was installed for radio communication. This has been working satisfactorily and has proved of considerable value where wire lines have not been built.

The following table indicates the existing mileage of roads, trails, and telephone lines within the National Parks, as of March 31, 1947:

National Parks	Roads				Trails	Telephone Lines
	Motor	Secondary	Fire	Total		
	Miles	Miles	Miles	Miles	Miles	Miles
Banff	182·4	10·5	98·5	291·4	745·55	273·0
Cape Breton Highlands	50·8	1·6	....	52·4	21·0	....
Elk Island	16·0	....	....	16·0	14·0	16·0
Glacier	....	....	20·5	20·5	91·0	1·5
Jasper	144·0	18·5	34·7	197·2	592·1	414·2
Kootenay	61·1	....	9·5	70·6	155·2	60·0
Mount Revelstoke	18·0	....	....	18·0	33·5	10·7
Point Pelee	6·5	2·8	....	9·3	....	....
Prince Albert	68·0	43·0	163·0	274·0	236·5	134·0
Prince Edward Island	7·1	3·0	....	10·1	....	....
Riding Mountain	51·6	52·9	....	104·5	113·0	149·0
Waterton Lakes	47·8	13·5	12·0	73·3	159·4	60·2
Yoho	46·0	6·5	25·0	77·5	191·0	69·5
Total	699·3	152·3	363·2	1,214·8	2,352·25	1,188·1

BUILDINGS

Building activity undertaken by the Parks Administration during the year was confined mostly to maintenance, repairs, and alterations, although a few small buildings which were urgently required were constructed.

In Banff Park, preliminary steps were taken by the administration for the removal to Banff of 33 buildings from Seebe Internment Camp, as well as 4 additional buildings which were being dismantled prior to removal. Wardens' cabins were completed at Stoney and Goat Creeks, the Healy Creek cabin was remodelled, a storage shed was built at Lake Louise Warden Station, and a floating boathouse constructed at Lake Minnewanka. In Tunnel Mountain camp-ground, 23 emergency shelter cabins for war veterans and one service building were built. In Kootenay Park, several small buildings were erected; a root house and a storage and office building were constructed at Radium Hot Springs, and a patrol cabin was built on Whitetail Creek northwest of Kootenay Crossing. Two single residences were started in Waterton Lakes Park to house members of the park staff who would otherwise have been unable to obtain year-round living accommodation in the townsite, while in Yoho Park 2 frame buildings were constructed for the storage of mechanical equipment and calcium chloride. In Cape Breton Highlands Park, 2 log cabins were completed along the highway between Pleasant Bay and Cheticamp, while in Elk Island Park a building to provide living accommodation for the staff was completed at the park headquarters.

TOWNSITES

The National Parks Bureau is responsible for providing normal municipal facilities in the townsites, such as streets; sidewalks; and public health services, including sewers, water supply, and garbage collection and disposal; and the control of building design, taking into account the utilitarian, aesthetic, and fire-prevention factors. These municipal services are operated on a repayment basis.

The general shortage in the supply of labour, materials, and new equipment increased the problems of those responsible for the operation of the municipal services, and although they were maintained efficiently, projects for improving or extending them were in some cases curtailed or delayed.

In Banff the Deer Street area was levelled and water and sewer lines were started to serve the newly constructed veterans' houses. A chlorinating plant was installed to treat the town water supply upon the firm recommendation of engineers of the Department of National Health and Welfare. At Radium Hot Springs in Kootenay Park a new dam was constructed at the water supply intake, while in Riding Mountain Park a transmission line was built from Erickson to Wasagaming to supply the latter with electric power from the Manitoba Hydro System.

TOURIST ACCOMMODATIONS AND CAMP-GROUNDS

The year was marked by the restoration of normal tourist facilities which, in some cases, were expanded. These facilities are of two general kinds. First there are the public camping and picnic grounds which are maintained and operated by the Parks Administration. And secondly, there are those maintained and operated by private enterprise.

The National Parks Bureau has laid out public camp-grounds in nearly all the parks for the benefit of those tourists who wish to take an economic holiday and to camp out in tent or trailer. These grounds have suitable lots for the erection of tents or for parking trailers, and are provided with water supplies, sanitary facilities, kitchen shelters with cooking stoves, fuel supply, and tables, and often with electrical plugs for the trailers. No extensions were made to any of the camp-grounds during the year, but they were all well maintained and operated, and were patronized by many thousands of tourists.

The tourist accommodations provided by private enterprise in the parks run from de luxe hotels, moderately-priced hotels, and rooming houses in the townsites to inexpensive cabins in auto bungalow camps outside the townsites. All are subject to supervision by the Administration.

The building program undertaken by private enterprise in the parks during the year may be listed as follows: In Banff Park, forty-seven new cabins were erected in the various auto bungalow camps, and four single detached houses, one duplex house, and one rooming house were constructed in the townsite. In Jasper Park, thirty-two cabins were built in the various bungalow camps and concessions lying outside the townsite, while seven cottages were completed and one duplex was started in the townsite. In Prince Albert Park, six new buildings were brought to an advanced stage of completion in the Lakeview subdivision; thirty-four cabins and five toilet buildings were practically completed in the Waskesiu Bungalow Camp, and ten cabins and one pump and power-house were almost completed at the Narrows Bungalow Camp. In Riding Mountain Park, one summer hotel, ten summer cottages, and five auto bungalow cabins were erected. In Waterton Lakes Park, four summer cottages were built in the townsite and three double cabins were completed in the auto bungalow camp. In Prince Edward Island Park, two summer cottages were erected at Wyand' Bungalow Camp, while in Cape Breton Highlands Park, the Provincial Government of Nova Scotia completed two eight-room cottages, four two-room cottages, one caretakers cabin, two staff dormitories, and one warehouse at Keltic Lodge.

NATIONAL HISTORIC PARKS AND SITES

The restoration, preservation, and administration of National Historic Parks and Sites, and the commemoration of the public service of outstanding characters in Canadian history are carried out by the National Parks Bureau.

In this phase of its work the Bureau is advised by the Historic Sites and Monuments Board of Canada, an honorary body composed of recognized historians representing the various parts of the Dominion.

The personnel of the Board is as follows: Chairman, Dr. J. Clarence Webster, Shediac, New Brunswick; Prof. Fred Landon, London, Ontario; Prof. D. C. Harvey, Halifax, Nova Scotia; Hon. E. Fabre-Surveyer, Montreal, Quebec; J. A. Gregory, North Battleford, Saskatchewan; Rev. Antoine d'Eschambault, St. Boniface, Manitoba; Major G. Lanctot, Dominion Archivist, Ottawa, Ontario; Prof. M. H. Long, Edmonton, Alberta; Prof. Walter N. Sage, Vancouver, British Columbia; W. D. Cromarty, National Parks Bureau, Ottawa, Ontario.

A general meeting of the Board was held in Ottawa, May 15-17, 1946, when many matters relating to the historic background of the Dominion were reviewed and sites to be marked were selected. Of the many sites considered by the Board to date 337 have been marked or acquired and 216 recommended for attention at a later date.

NATIONAL HISTORIC PARKS

Fort Anne National Historic Park, Annapolis Royal, Nova Scotia:—The east side and north end of the museum building and all wood-work downstairs in the north and south halls were painted, together with the library, cannon, and cannon balls around the building, the chain fence, well-sweep, and sign posts; the roads were repaired, magazines were cleaned, the moat drained, a new floor was laid in the bandstand, and repairs were made to the bases of the columns at the entrance to the museum; the hedges around the memorials were trimmed and the hay was cut and removed from the fort grounds facing the highway.

Additional articles of historical interest were obtained for the museum and a four-page leaflet was published containing a condensed version of the history of the fort.

Port Royal National Historic Park, Lower Granville, Nova Scotia:—Preserving fluid was applied to all shingled roofs and to the cannon platform, palisade, and new built-in bunks; additional furnishings, including four baby harbour seal skins, were obtained for the various rooms; all iron work was cleaned and oiled, bridges were repaired, the cannon was painted, and the lawns were rolled and fertilized.

Fortress of Louisbourg National Historic Park, Louisburg, Cape Breton Island, Nova Scotia:—A section of the breast-work near the main entrance was dismantled and rebuilt; the cairn near the west gate, marking the Dauphin's Bastion, was taken down and the tablet was affixed to the remains of the Bastion which has been partly restored; repairs were made to the north-west walls of the casemates, the doorway in the citadel was rebuilt, and concrete bases were made for the cannon; the main entrance gate, the fence enclosing the Society of Colonial Wars memorial, and all windows in the museum building and caretaker's quarters were painted, as were the cannon and anchors in front of the museum; the bridge across the moat at the citadel was repaired, part of the entrance road was re-surfaced and the lawns and paths were kept in good condition.

Fort Beausejour National Historic Park, Sackville, New Brunswick:—The stonework of the museum building was caulked and made waterproof; the caretaker's residence, rest lodge, and cannon were painted; the pavilion provided for the convenience of visitors was moved to a more suitable location; repairs were made to one of the stone pillars at the main entrance gate; all road signs were relettered, and the grounds were maintained in good condition.

Fort Chambly National Historic Park, Chambly, Quebec:—Flagstone walks were laid in the picnic grounds; the iron fence around the cemetery and in front of the fort, the picnic tables, and the storm doors were painted; the trees and shrubs were trimmed, and the grounds were kept in good condition.

Fort Lennox National Historic Park, Ile-aux-Noix, Quebec:—Permission was granted to the Jeunesse Etudiante Catholique Organization to use a portion of the park property during the summer months as a youth training centre; the metal roof on the Powder Magazine was painted, the roof of the Officer's Quarters was repaired and the entrance to the latter building was repaired and painted; a new floor was laid in the Men's Barracks, a temporary landing dock was constructed on the east side of the island, and a cement platform was built around the well; repairs were made to the entrance bridge and to the windows in the various buildings; the parade ground was levelled, casemates and picnic grounds were cleaned, brush and dead trees along the embankment were cut and removed, and the grounds were kept in good condition.

Fort Wellington National Historic Park, Prescott, Ontario:—The old fence around the fort property was taken down; the new palisades were erected to replace those in poor condition; all fort buildings and cannon were painted; repairs were made to the entrance gates; new signs were made and placed in position; trees and shrubs were planted, and the grounds were kept in good condition.

Fort Malden National Historic Park, Amherstburg, Ontario:—The top floor of "The Fort" residence was converted into living quarters for the park custodian and arrangements were made with the Provincial Government for a police constable to occupy the dwelling known at "The Cottage" to give additional protection to the property. A small bronze plate was attached to the "Tecumseh Stone" donated to the park; the existing tile drain was extended into the sunken garden; repairs were made to the plumbing of the "Fort" and several sections of the rain conductor pipe on this building were replaced; additional fire extinguishers were obtained, lawns and hedges were trimmed, and many articles of interest, including a large anchor, were presented to the park.

Fort Prince of Wales National Historic Park, Churchill, Manitoba:—General supervision was continued throughout the year.

NATIONAL HISTORIC SITES

Franklin Delano Roosevelt, Welshpool, Campobello Island, N.B.:—A cut-stone monument bearing an engraved tablet was erected near the library building to the memory of Franklin Delano Roosevelt, 1882-1945, statesman and humanitarian, who, during many years of his eventful life, found in that tranquil island, rest, refreshment, and freedom from care. To him it was always the "beloved island". The monument was unveiled on August 1, 1946, in the presence of a distinguished gathering including Mrs. Eleanor Roosevelt.

Father Jacques Marquette, Boucherville, Quebec:—A cut-stone monument, with tablet affixed, was erected in the small park lying between Highway No. 3 and the St. Lawrence River to commemorate the public services of Father Jacques Marquette, who was born in France on June 10, 1637. With Louis Jolliet he discovered the Mississippi River on June 17, 1673. He visited the seigniory in which the monument stands in May, 1668, and died in Michigan on May 18, 1675.

William Wilfred Campbell, Kitchener, Ontario:—A bronze tablet was erected in the Kitchener and Waterloo Collegiate building in memory of William Wilfred Campbell, Canadian poet, who was born in Berlin (Kitchener) on June 1, 1858, and died near Ottawa on January 1, 1918. His verses revealed the beauty of the Great Lakes, "the magic region of blue waters". The tablet was unveiled on November 25, 1946.

Sir James Douglas, K.C.B., Victoria, B.C.:—A bronze tablet was erected at the entrance to the Legislative Chamber in the Parliament Buildings to commemorate the public services of Sir James Douglas, 1803-1877, "The Father of British Columbia". In his early life he was associated first with the North West Company and later with the Hudson's Bay Company. He founded Fort Victoria in 1843. By his firm and wise rule as Governor of Vancouver Island, 1851-1864, and Governor of British Columbia, 1858-1864, he laid the foundation of that province. The tablet was unveiled on November 19, 1946.

Frederic William Howay, New Westminster, B.C.:—A bronze tablet was affixed to the Court House in memory of Frederic William Howay, Historian of British Columbia and Judge of the County Court of Westminster, 1907-37, Member of the Historic Sites and Monuments Board of Canada, 1923-41, Chairman, 1941-43, and President of the Royal Society of Canada, 1941. Born near London, Ontario, on November 25, 1867, he died in New Westminster on October 4, 1943. The tablet was unveiled on November 25, 1946.

During the year all the sites which have been marked on the advice of the Board were suitably maintained. These include Indian earthworks, forts, and villages; French forts, trading posts, and mission enterprises; sites connected with British exploration and naval and military operations in the long struggle for the possession of Canada; posts of the Hudson's Bay Company, and sites related to the social, economic, and industrial development of the country.

RECREATIONAL FEATURES

The National Parks serve as centres of outdoor life and recreation for both summer and winter sports. Hundreds of miles of smooth roads and thousands of miles of well kept trails provide access to all parts of the parks where the vacationist may enjoy the natural beauty of the scenery and the abundant wildlife resulting from the sanctuary conditions.

Favourite summer sports include hiking, riding, mountain climbing, boating, canoeing, swimming, fishing, tennis, and golf. Many of the Parks possess golf courses, some of which are equal to the finest on the continent, as well as tennis courts. Active consideration is being given to the provision of bowling greens in several of the larger parks. Work was started on greens in Riding Mountain Park, and plans are being made to commence similar work during 1947 in Banff, Jasper, Cape Breton Highlands, and Prince Edward Island Parks.

Winter sports, including skiing, skating, and curling, are popular in several of the parks. Banff Park in particular has developed into an outstanding resort for winter sports and is the centre of a vast territory where skiing lasts from December until April.

Special Events

Some events which had lapsed during the war years were resumed, and others were marked by greatly increased and, in some cases, record attendance.

The leading events in the National Parks during the year may be listed as follows: Golf tournaments were held in Banff, Riding Mountain, Prince Albert, and Waterton Lakes Parks, and two tennis tournaments were held in Prince Albert Park. The Trail Riders of the Canadian Rockies had two camps in Banff Park, and the Trail Hikers of the Canadian Rockies and the Skyline Trail Hikers had their annual encampments in Yoho Park. The Seattle Mountaineers and the Ohio Mountaineers Club camped in Glacier Park, and the "Mazamas", a Mountaineer Club from Portland, Oregon, had their annual camp in Yoho Park. Successful ski meets were held in Yoho, Mount Revelstoke, Banff, and Jasper Parks, and bonspiels and winter carnivals were held in Banff and Jasper Parks.

Other popular events included the Indian Days Celebration between July 18-21, and a regatta on May 24th, which were resumed at Banff after having been discontinued for some years. Sing-songs and get-together meetings in the community buildings in the public camp-grounds are becoming increasingly popular in many of the parks.

The Banff School of Fine Arts, an extension of the University of Alberta, which since 1933 has been giving summer courses in drama, ballet, art, music, handicrafts, oral French, and short story and play writing, has gained an international reputation and is drawing students from widely scattered places on this continent who come to combine creative work in the fine arts with delightful recreation in the Canadian Rockies.

Conventions

The National Parks are becoming increasingly popular as convention centres. The Pacific Loggers' Congress, the Canadian Medical Association, and the Kinsmen's National Club held their annual conventions in Banff. The Rotary Convention and the Physical Education Conventions were held in Jasper. The Cosmopolitan Club and Bowman Bros. Ltd. held their annual conventions in Prince Albert Park. Riding Mountain National Park was the scene of conventions and meetings held by the following organizations: Anglican Clergy of Brandon Diocese, Manitoba Agricultural Representatives, North West Dental Association, Manufacturer's Life Insurance Company, Lions Club, Co-operative Commonwealth Federation, Manitoba Rotary Clubs, Manitoba Fish and Game Association, and the North West Manitoba Druggists. The District Convention of the International Lions Clubs of Alberta and Montana was held in Waterton Lakes National Park.

PUBLICITY

The first full year of peace after the cessation of hostilities was marked by an increased interest in the National Parks as vacation areas and resulted in a keen demand for information regarding recreational facilities, accommodation, camp-grounds, and a variety of other details. Most of these inquiries are answered in the information folders, but some requests for specific information required individual replies.

The following quantities of literature were distributed:

Booklets—	
Playgrounds of the Prairies	7,669
Canada's Mountain Playgrounds	12,108
Playgrounds of Eastern Canada	34,544
Elk Island	273
Annual Report	865
Geology of the National Parks	750
Folders—	
Jasper	10,633
Kootenay, Yoho, Glacier, and Mount Revelstoke	11,150
Waterton Lakes	6,650
Banff	4,320
National Parks	20,701
Prince Albert	8,180
Riding Mountain	1,515
Elk Island	1,317
Cape Breton Highlands	3,814
Prince Edward Island	15,537
Point Pelee, Georgian Bay Islands, and St. Lawrence Islands	9,050
Miscellaneous—	
Banff-Jasper Strip Map	31,625
Sport Fishing in Canada's National Parks	7,100
Mount Eisenhower Postcards	10,000
	197,801

Motion pictures and still photographs from the Bureau library depicting the scenery, wildlife, and recreational facilities in the National Parks were lent to many individuals and organizations requesting them. In this manner 5,715 films were distributed, 4,966 in the United States and the remainder in Canada. These films were displayed at 20,982 showings, with a total of at least 2,119,616 persons attending. Two wildlife films were televised from stations in the United States.

In addition, seventy-four articles and press releases, accompanied in many cases by half-tone cuts, mats, or photographs, were sent to the daily and weekly press, to various magazines, and to several radio stations in Canada and the United States. Emphasis was placed upon the camping facilities in the parks with the object of relieving pressure on hotel and cabin accommodation.

Addresses on Canada's National Parks were given to service clubs and Boards of Trade in Belleville and Picton, Ontario; Winnipeg, Manitoba; Calgary and Edmonton, Alberta; Victoria, British Columbia; Montreal, Quebec; Malone, New York; and in Columbus, Ohio.

During the latter part of the year all films and equipment were transferred to the National Film Board, and all exhibition material to the Canadian Government Exhibition Commission.

USE OF ALTERNATIVE SERVICE WORKERS

On July 15, 1946, all Alternative Service Work Camps in the National Parks were officially closed. These camps were first established in 1941 for the employment of conscientious objectors exempted from military training, and most of them had been in operation ever since.

By the beginning of April transfers to agriculture and industry had so reduced the numbers of men in these camps that it was decided, in the interests of economy, to close the camps in Kootenay and Jasper Parks and concentrate the remaining workers at Banff. This reduced the camps to two, one at Banff and one at Riding Mountain, both of which continued in operation until July 15, 1946.

During the three-and-a-half-month period that these camps remained in operation 139 conscientious objectors were employed. This number gradually decreased until, by July 15, only 70 men remained. Work projects were limited by the small number of men available, and were concentrated mainly on the maintenance of park facilities. Although some exceptionally good workers were noted, the majority were men of poor quality who had been brought to camp under police escort. As a result of their attitude and the small number of men available the return of work was not as satisfactory as in former years. In spite of these handicaps much useful work which otherwise could not have been done was completed.

DOMINION FOREST SERVICE

The contribution to the war effort made by Canada's forests and the subsequent interest in forestry matters created by Royal Commissions in British Columbia, Saskatchewan, and Ontario have focused public attention on the need for the application of scientific principles in the conservation and development of forest resources. In the main the forest areas are controlled by the provinces, which are responsible for their administration and protection. Nevertheless, their economic importance to the development of Canada as a nation is such that their proper management is a matter of prime concern to the Dominion Government.

Federal responsibility in forestry is mainly expressed in the contributions made by the Dominion Forest Service through fundamental research in silviculture, forest protection, aerial photography, and wood utilization. Since certain forestry problems are common to several provinces, research work by the Dominion is complementary to provincial activities and integrated for the development of a national forest policy.

The increased interest of the public in the conservation of forest resources was recognized by Parliament in the granting of increased appropriations for research. The staff has been considerably enlarged through the return of former employees from the armed services and the hiring of additional technical foresters: more facilities have also been made available. The result has been the expansion of the work of the Dominion Forest Service during the year under review to a scale greatly in excess of that undertaken in the past sixteen years.

Silvicultural research is conducted chiefly on five forest experiment stations but also extends to provincial lands; investigations in all phases of wood utilization are carried out by three forest products laboratories.

Research problems as regards forests and forest products are worked out in co-operation with the provincial forest services, with forest industries, and with the Department of Agriculture in the fields of entomology and pathology. The results obtained from such investigations are made available to all interested agencies.

During the past year, a substantial beginning was made on an enlarged program of fundamental research work which, it is hoped, will be expanded as technical staff and facilities become available. Such a program is essential if the Dominion is to supply the vigorous leadership required for the development of a much-needed national forest policy, the objective of which is to grow and maintain forests on all lands available in Canada for forest management, and to develop types of management that will assure maximum yields in terms of wood products, protection of stream-flow, and other forest values.

FOREST ECONOMICS DIVISION

Production in the forest industries of Canada was maintained at a higher level in 1946 than in any other peace-time year. Despite a five-week shutdown in the lumber industry on the west coast, lumber production for the year was estimated at about 4,776,000,000 ft. b.m. The continued demand for housing and other forms of construction at home, coupled with increased export demand, will provide a stimulus for even greater lumber production in 1947.

The great differences existing between domestic ceiling prices and world prices necessitated rigid control of exports by the Timber Control of the Department of Reconstruction and Supply. It was found expedient, however, to make certain upward price adjustments in order to encourage increased production.

Control of the pulp and paper industry by administrators of the Wartime Prices and Trade Board was discontinued in November, 1946, bringing an unrestricted market in the United States for Canadian newsprint and pulp. Newsprint production for the year reached an all-time high, totalling over 4,100,000 tons. Ninety-three per cent of this production was exported, eighty per cent going to the United States.

The following table shows the average rate of utilization and destruction of merchantable timber during the ten-year period 1935-44. In order to make Canadian statistics directly comparable with those of foreign countries, converting factors are used which give cubic volumes of merchantable wood only, excluding stumps and tops.

Average Annual Depletion, 1935-44

	Millions of cubic feet of usable wood
Volume used	2,380
Merchantable timber burned	348
Destroyed by insects and tree diseases	500
Total depletion	3,228

About 74 per cent of the total depletion was used and 26 per cent wasted. Replacement of this depletion requires an average annual growth rate of about 11 cubic feet of merchantable wood per acre over the 278 million acres of accessible productive forests of Canada. Since the accessible stand of merchantable timber is estimated at 191,348 million cubic feet, average annual depletion during the decade amounts to 1·7 per cent of total volume. While this does not seem an excessive rate of depletion, it must be remembered that the abnormal demand for forest products since 1939 has resulted in severe overcutting in certain localities, whereas the annual growth is not being used on the more inaccessible areas.

The relative importance of the principal branches of the forest industries in 1944 is indicated in the following table:—

FOREST INDUSTRIES

Summary of Principal Statistics, 1944

—	Employees	Salaries and Wages	Net Value of Products	Gross Value of Products
	No.	$	$	$
Woods operations	118,500[1]	195,000,000	237,000,000	301,570,823
Lumber industry	43,516	51,516,085	96,528,955	216,556,623
Pulp and paper industry	37,896	75,833,408	174,492,103	369,846,086
Wood-using industries	48,771	64,467,588	105,060,380	214,088,355
Paper-using industries[2]	18,927	25,784,320	55,990,228	125,342,444
Total	267,610	412,601,401	669,071,666	1,227,404,331

[1] Man-year basis. [2] Not including printing trades.

The net value of the products of the forest industries in 1944 was 11·0 per cent greater than in 1943 and 93·7 per cent greater than in 1939.

The work of the Economics Division of the Forest Service was seriously handicapped owing to the loss in June of the two senior members of the staff. In addition to the normal activities of the Division, a report entitled "Canada's Forests and the War" was prepared for presentation to the Fifth British Empire Forestry Conference. This report included chapters submitted by the Forest Products Laboratories and by the National Selective Service of the Department of Labour, and a history of the Canadian Forestry Corps.

FOREST AIR SURVEY DIVISION

The work of the Forest Air Survey Division concerns the use of air photographs in the survey of the forests of Canada. As no natural resource is better adapted to detailed study by air photographs than the forest, this work has assumed special importance. From the research standpoint, a fertile field exists in the development of technique and scientific apparatus and in the obtaining of data on the ground to aid in the interpretation of air photographs in regard to timber quantities and other forest information. An opportunity to couple research with practice has arisen in the forest mapping of federally administered lands such as the Northwest and Yukon Territories, Indian reserves, National Parks, and forest experimental areas, as well as in cases where provincial lands have been mapped in co-operation with the provinces.

The training of new men in the technique of forest typing was an important feature of the year's activites. It was greatly facilitated by numerous ground investigations carried out to amplify interpretation of air photographs. Experience acquired on active service by these men in the use of air photographs substantially aided and simplified the training program.

During the year, a total area of some 50,000 square miles was photographed for forestry purposes at the request of the Dominion Forest Service in the national program of air photography. This included forestry tri-camera photography on 2,800 square miles carried out under winter conditions.

Forestry tri-camera photography, initiated by the Dominion Forest Service, was first employed this year in an effort to provide a method of air photography which will meet the special needs of the forester for maximum forest detail at lowest cost under conditions where it is desirable to rephotograph periodically in order to record the changes that take place in the forests. Advantage has been taken of the fact that the comparatively rigid requirements of air photography for basic mapping do not apply in the field of forestry. The chief feature of the method is the low-angle or steep oblique photograph. The forestry tri-camera photographs taken during the year have demonstrated both the economy of operation and clarity of detail that are possible with this new style of forest photography. For instance, it was shown that both hardwoods and softwoods can be photographed to best advantage in winter photographs. Also it became evident that by variations of lens and tilt the forestry tri-camera mount could be adapted to obtain simultaneously two sets of photographs covering the same ground, thus satisfying in a single photographic operation the scale requirements of both the mapper and the forester, the former desiring a smaller scale to facilitate the preparation of the basic map.

In continuation of work done during the previous year, a part of the year's activities was devoted to the preparation of general forest inventory map sheets in various provinces, the intention being to illustrate the possibilites of air photographs for the purposes of a national forest inventory and to obtain a more definite basis for discussion of inventory problems with the provinces. As a result, a development of considerable significance occurred in the form of photolithographed forest inventory maps which are prepared largely from air photographs, and which require a minimum of ground work. This development, which was made possible by the co-operation of the Geographical Section, General Staff, Department of National Defence, is of particular importance, as it enables quantity production of maps in full colour at a very cheap rate. The maps, as recently standardized, show the forest classified according to type, crown cover, and height, these being the factors most readily derived from air photographs. The maps are printed on a scale of one mile to one inch. Broad estimates of timber quantities can be derived from such maps. If supplemented by field data covering species, quality, age, and site, the maps will provide a very comprehensive picture of the forest conditions obtaining. These general forest inventory sheets were compiled for an area totalling 6,350 square miles. At the same time, three map sheets, totalling about 1,200 square miles, came off the press.

In preparation for inventory work in Manitoba, provisional maps covering 144 square miles were prepared for delivery to provincial forest survey parties. These maps, supplemented by ground data secured by the field parties, will be used as the basis for photolithographed forest inventory map sheets.

In the case of federally administered lands, where special maps are usually required, showing more detail than those used for general forest inventory mapping, forest maps were prepared for a total area of 465 square miles. These covered 400 square miles in Prince Albert National Park, the 30-square-mile Waterhen Lake Indian Reserve, and 35 square miles on the borders of the Petawawa Forest Experiment Station.

During the year, there was considerable acceleration in the application of the special methods which have been developed as a result of research by the Dominion Forest Service in the use of air photographs for forestry purposes. Foresters from provincial forest services and forest industries studied the Division's methods, and some of them visited Ottawa for considerable periods to obtain information on its latest developments. Visits were made by members of the forest air survey staff to other forest organizations in order to correlate the techniques being developed. A general article was prepared for submission to the Fifth British Empire Forestry Conference, and papers were written for presentation to photogrammetric societies. The work of gathering data in the field to supplement quantitative estimating of the forests was proceeded with, particularly in co-operation with the Brompton Pulp and Paper Company.

An instrument for visual measurement of the percentage of crown cover was developed. This device, which because of its shape has been named the "Moose-horn", is used in gathering data on the ground. A shadow height calculator has been developed to carry out graphically and mechanically all the processes necessary in the determination of tree heights from shadows in air photographs. Incorporated in this calculator is an adaptation of a centuries-old device known as the "Mathematicall Jewell", a description of which may be found in "Astrographics", written by Frank Debenham, Professor of Geography at the University of Cambridge. Rheostats have been mounted on instruments of the duoscope-monoscope type and have been very successful as a means of regulating the illumination.

In order to promote the use of air photographs as an aid to site classification, field trips were made to the forest survey parties of two timber holding companies, and studies were carried out which resulted in the preparation of reports that are of general scientific interest for forest working plan purposes.

SILVICULTURAL RESEARCH DIVISION

During the year, silvicultural research was reorganized on a more effective basis than was previously possible, as a result of the return of foresters from the armed services, and the acquisition of additional technical and non-technical staff. This made possible the resumption of work on many projects previously under way, and the undertaking of new ones. For this work the Division was fortunate in securing the services of several promising young foresters capable of doing much of the original thinking in connection with the projects assigned to them.

Reproduction Surveys:—One of the most important new projects undertaken was a comprehensive investigation of reproduction and forest growth on disturbed stands. This undertaking resulted from a resolution passed at the annual summer meeting of the Woodlands Section, Canadian Pulp and Paper Association, held at Petawawa in 1945. This work was begun in May, 1946, and was designed to obtain data concerning reproduction on various forest sections across the Dominion. Surveys were conducted in Nova Scotia, New Brunswick, Quebec, and Alberta; standardized methods of collecting data were employed, so that direct comparisons will be possible. It is expected that this work will continue for at least another year before sufficient data will be available to allow judgment of the rate at which the forests are reproducing. When these facts are known, the second stage of this investigation will involve a study of why certain areas are not reproducing satisfactorily, following which steps will be taken to determine action required. Reports on 1946 surveys are not yet complete, but an examination of the data so far available indicates that certain important conclusions may be drawn, particularly with respect to spruce and balsam.

Rate of Growth Surveys:—Work on rate of growth surveys during the year was confined to the remeasurement of line plots established during the past 20 years. Remeasurement surveys were conducted as follows: New Brunswick, Acadia Forest Experiment Station and Salmon River; Quebec, Lake Edward Station; Ontario, Goulais River, Algoma District; Manitoba, Riding Mountain National Park; Saskatchewan, Carrot River area; Alberta, Kananaskis Forest Experiment Station. Final reports on the results of these surveys are now in course of preparation.

MARITIMES DISTRICT

One of the most promising forest management projects in the Maritimes District is the Green River budworm project in New Brunswick. This is a joint undertaking by the Dominion Forest Service, the Dominion Entomological Service, the Province of New Brunswick, and the Fraser Companies. Its purpose is to investigate silvicultural methods of controlling the budworm epidemic. In 1945, a series of permanent line-plots was established on a block of some 4,000 acres, and information on all existing forest conditions, particularly age-classes, reproduction, and rate of growth, was gathered. In the year under consideration a further block of 4,000 acres was established, on which a selective cutting was carried out. The following quantities (cords) of spruce and balsam were removed:—

	Section 1	Section 2	Section 3	
Sap-peeled	5,006	1,317	2,000	
Rough	31,965	3,928	6,652	
Total	36,971	5,245	8,652	
Grand Total				50,868

This whole area is being made accessible by roads, and by cutting on a 10-year cycle it is hoped to build up the stocking and growth so that one cord per acre per year may eventually be harvested.

The Salmon River experimental cutting area, which has been established for 22 years, was again remeasured, and it is expected that on the basis of this work a research note on the management of such areas will be issued.

The Woodlot Management Project, which is a co-operative undertaking with the Federal Department of Agriculture, Experimental Farms Division, is progressing satisfactorily. The Dominion Forest Service each year marks the trees to be cut, and the co-operating farmer does the actual cutting. Working plans are now in operation for some 16 woodlots in the Maritime Provinces.

Acadia Forest Experiment Station.—At the Acadia Station, the working plan sample plots established 10 years ago were remeasured, and the cutting budget will be revised in accordance with the findings. Three demonstration woodlots were established here for management on a sustained yield basis. All permanent sample plots in experimental cutting areas and in plantations due for such treatment were remeasured.

QUEBEC DISTRICT

A new project undertaken by the Division in Quebec during the past year was the examination of the result of 20 years of planting conifers at Proulx by the Laurentide Pulp and Paper Company, now owned by the Consolidated

Paper Company, Grand'Mère. These plantations, if ultimately successful, should yield valuable information, not only on growth but on the economic possibilities of reforesting areas adjacent to mills.

Valcartier Forest Experiment Station.—The Valcartier Station, which had been closed during the war, was re-opened in the autumn of 1945. Initial activity involved the remeasurement of projects due and overdue, including the working plan, sample plots, and intermediate harvest cuttings and plantations. A demonstration woodlot was established and placed under a working plan, and the first annual cutting was completed. The Lake Edward Experimental Area was resurveyed by means of line plots, and a periodical report of growth in this former cut-over area will be issued.

PETAWAWA FOREST EXPERIMENT STATION

During the past year, the Petawawa Station was, for purposes of management, divided into some 60 compartments, varying in size from 1 to 2 square miles. To determine the merchantable stock and the factors affecting growth, composition, site, age-class, and density, a series of permanent line plots will be established in each compartment. These will be used to lay out cutting operations and many research investigations. Plots were established on two compartments operated during the past winter for multiple use—saw-timber, match-stock, pulpwood, and fuel-wood all being removed in a single operation. Pine and poplar match-stock was removed from another area to demonstrate selective cutting. Some 60 permanent sample plots for study of growth and reproduction were measured. Tests of the relative values of various forms of permanent sample plots are being made, and seem to indicate that rectangular plots are most generally desirable.

Tree-breeding projects were conducted with white pine, spruce, and poplar. Preliminary work was commenced in studies of many factors concerned with the reproduction of pine and spruce. The demonstration woodlot established on this area under a five-year working plan was remeasured and the cutting budget revised.

MANITOBA-SASKATCHEWAN DISTRICT

Forest research in this district has been reorganized on an expanded basis. In Riding Mountain National Park, approximately half an area of some 25 miles set aside during the year for a research station was sampled by permanent line plots. With the completion of this survey, a working plan will be made to provide for the removal of the increment in the form of demonstration cuttings. Some 600 new permanent line plots were established for study of growth. Permanent sample plots established five years or more ago were remeasured.

The Carrot River experimental cutting area was remeasured and a report prepared summarizing the results of cutting carried on 23 years ago. Many seeded and planted plots as well as permanent sample plots were remeasured.

ALBERTA DISTRICT

Kananaskis Forest Experiment Station.—With the close of the internment and alternative service work camps, forest research work was resumed. The principal project on the Station during the past season was the remeasurement of 1,000 permanent line plots, the data being essential to the development of a working plan for this area. Plots established in intermediate cutting areas were also remeasured. A new project, that of classification of soil types, was initiated in co-operation with the University of Alberta, and covered about one-third of the Station area. The salvage cutting in the 1936 burn on the Kananaskis Station was continued until the close of the alternative service work camps there.

FOREST PROTECTION DIVISION

During the fire season of 1946, some 860,000 square miles of forest and wild land throughout Canada were protected by the various forest authorities. This area is more than 100,000 square miles greater than that protected in 1945, the increase being due, almost entirely, to the inclusion of the Yukon and Northwest Territories.

In 1946, for the first time, estimates of forest-fire losses in the Territories became available. These statistics are shown in the accompanying tables, but are listed separately from those of the provinces (including Dominion Lands within provincial boundaries) so as to provide a basis for comparing Dominion totals with those of former years. Such comparisons as are noted hereunder do not include fires in the Yukon and Northwest Territories.

FIRE LOSSES

Although the number of forest fires in 1946 was slightly greater than the average for the past ten years, the total area burned and estimated values destroyed were less than half the average figures (See Table I). Merchantable timber losses included 102,102 thousand feet board measure of saw timber and 454.468 cords of small material, comprising only about one-sixth of the previous ten-year average.

Forest-fire losses in the Maritime Provinces were somewhat higher than normal, although not as serious as in the exceptionally severe fire season of 1944. Elsewhere in Canada the damage caused by forest fires was well below the average. Fire losses for each province and for lands under Dominion administration are shown in Table III. Only one death resulting from a forest fire was recorded during the year.

The cost of fire-fighting, $897,940, was a little lower than the average for the previous ten years. Actual fire-fighting costs, however, represent only a fraction of the total cost of forest-fire protection, which includes such items as salaries and wages of permanent employees, purchase and maintenance of equipment and improvements, and fire-prevention expenditures. Estimates of total fire-protection costs are now being compiled, but, owing to differences in the fiscal year used by the various forest authorities, complete estimates for 1946 will not be available until next year.

CAUSES OF FIRES

Forty per cent of all forest fires in 1946 were caused by carelessness on the part of campers and smokers (Table II)—an increase of 6 per cent over the ten-year average. Settlers were responsible for 11 per cent, and railways for 12 per cent of the total number. Although the proportion of railway fires was smaller than in 1945, it was still considerably higher than in pre-war years. Sixteen per cent of the fires were attributed to lightning, the only unpreventable cause.

LEGAL PROCEEDINGS

Prosecutions under the forest-fire laws were instituted in 197 cases, and resulted in 182 convictions (Table IV). Both figures were somewhat higher than in the previous year.

Weather Conditions

Nova Scotia.—The 1946 season was generally one of high fire-hazard. The long dry periods were, however, broken by occasional showers and dull weather, bringing temporary respite.

New Brunswick.—Weather conditions during the first half of the fire season were normal, and no serious fire losses occurred. From early July until the middle of October, precipitation was generally deficient throughout the Province, especially in the eastern counties. Rain in the latter part of October relieved the hazard in most areas, although drought conditions in the southeastern section persisted until early winter.

Quebec.—During the spring hazard period precipitation was normal over most of the Province, although drier weather than usual was experienced in the Lake St. John district. June was a relatively dry month in most regions, but during the remainder of the season rainfall was generally adequate, especially in the northern and western areas. The Lake St. John and Gaspé districts, however, suffered from a deficiency of precipitation in August, which in Gaspé continued through September.

Ontario.—The fire season on the whole was a moderate one. Warm weather caused a short period of fairly high hazard in the eastern districts toward the end of March, but conditions were generally favourable during April and May. A high hazard developed in western Ontario in the first part of June, and in the Sudbury and Parry Sound districts during parts of July, August, and October. Otherwise no acute or prolonged periods of fire danger were experienced in the latter part of the season.

Manitoba.—The fire season started two weeks earlier than usual, and rainfall was generally deficient until past midsummer. By the end of August conditions approached normal and did not alter radically during the remainder of the season. Fortunately the rains were well spaced, which helped in keeping down fire losses.

Saskatchewan.—Weather during the 1946 season was extremely variable. Periods of cool, damp weather, with slightly lower than average precipitation, alternated with very high temperatures accompanied by strong, drying winds. The highest hazard occurred in two such periods—one in April and one in September; the greatest fire losses occurred during the latter period.

Alberta.—A high fire-hazard developed in the spring over wide areas in the northwestern part of the Province, a condition which lasted with little respite until the middle of November. Elsewhere in Alberta the hazard was generally well below normal throughout the season, except for a warm, dry period in the southwestern districts which lasted from early July until the latter part of August.

British Columbia.—Considering the Province as a whole, the weather during the 1946 fire season was more favourable than average. Although high-hazard periods occurred in all districts, notably in the early spring and at midsummer, timely precipitation generally prevented the build-up of prolonged drought conditions. An exception occurred in the northern part of the Kamloops district, where an unusually severe spring hazard developed; this condition remained almost unabated throughout the season.

Yukon.—High fire-hazards prevailed in the southern Yukon throughout the month of June, and for a short period in September. At other times weather conditions were generally favourable.

Northwest Territories.—No information is available regarding weather conditions during the 1946 fire season.

Forest Fire Research

Since 1929, the Forest Protection Division has carried out research on fundamental problems relating to forest-fire control. Perhaps the most important contribution in this field has been the development of forest-fire danger tables, by means of which the prevailing degree of fire danger can be determined according to weather conditions and seasonal influences.

A revised and somewhat simplified edition of these tables was published in 1946, and was adopted by a number of forest protection services in Canada and Newfoundland. The adaptation of the system to regional and local conditions is still in progress. Work has also been started on a study of adequate forest-fire protection standards for the various forest regions of Canada.

After a lapse of four years, intensive fire-hazard studies were resumed at the Kananaskis Forest Experiment Station, where a fire-danger rating system suitable for use on the east slope of the Rocky Mountains is being developed. Particular attention was devoted to the study of abnormal temperature conditions which cause low night humidity at the higher altitudes on steep slopes. Other projects included the use of hygroscopic chemicals in an effort to develop a simple fire-hazard indicator; an investigation of the effect of site and method of exposure on wet- and dry-bulb hygrometer readings; efficiency tests on portable fire pumps in several of the western National Parks; and further studies of the effect of altitude and other factors on fire-pump performance.

Forest-fire research at the Petawawa Forest Experiment Station was mainly devoted to the development of fire-control planning methods and techniques. A fire plan for the Station was prepared, which establishes fire-control objectives, and specifies the equipment and organization required, together with the state of preparedness to be maintained by the protection force according to the prevailing degree of fire danger. Maps are provided showing fuel types, risk areas, travel routes and travel-time zones, areas visible from lookouts, and fire-fighting facilities.

Studies of weather and fuel moisture content were continued at Petawawa in 1946. An investigation of the value of certain chemicals for retarding the growth of vegetation on fire-guards and roads, which was suspended during the war, was resumed. Tests were also made of the performance of 10-metre "walkie-talkie" radio sets under forest conditions.

TABLE I

Forest-fire losses in Canada, 1946, compared with 10-year average, 1936-45

Item		Provinces*		Yukon and Northwest Territories Year 1946
		Annual Average 1936-45	Year 1946	
Fires under 10 acres	No.	3,811	4,372	17
Fires 10 acres and over	"	1,702	1,531	57
Total number of fires		5,513	5,903	74
Area burned—				
Merchantable timber	acres	553,455	109,478	296,396
Young growth	"	660,059	190,914	24,880
Cut-over lands	"	357,650	128,591	3,880
Non-forested lands	"	858,226	587,723	1,148,591
Total area burned	acres	2,429,390	1,016,706	1,473,747
Merchantable timber burned—				
Saw timber	M. ft. b.m.	779,565	102,102	8,669
Small material	cords	2,442,265	454,468	257,297
Estimated values destroyed—				
Merchantable timber	$	2,579,973	635,268	270,064
Young growth	$	899,177	384,069	3,210
Cut-over lands	$	294,634	94,426	3,895
Other property burned	$	545,259	710,949	....
Total damage	$	4,319,043	1,824,712	277,169
Actual cost of fire-fighting	$	914,903	897,940	7,659
Total damage and fire-fighting cost	$	5,233,946	2,722,652	284,828
Area under protection	sq. mi.	....	750,000	110,000

* Includes Dominion Lands within provincial boundaries.

TABLE II

Forest fires in Canada, 1946, by causes, compared with 10-year Average, 1936-45

Cause	Provinces*				Yukon and Northwest Territories Year 1946	
	Annual Average 1936-45		Year 1946			
	No.	%	No.	%	No.	%
Camp-fires	961	17	1,068	18	62	84
Smokers	961	17	1,293	22	3	4
Settlers	763	14	622	11	....	....
Railways	368	7	691	12	....	....
Lightning	1,025	19	956	16	3	4
Industrial operations	155	3	293	5	....	....
Incendiary	302	5	163	3	1	1
Public Works	48	1	57	1	1	1
Miscellaneous known	467	9	439	7	....	....
Unknown	463	8	321	5	4	6
Totals	5,513	100	5,903	100	74	100

* Includes Dominion Lands within provincial boundaries.

TABLE III

Statistics of forest fires by regions, 1946

(Averages given are those for 10-year period 1936-45)

—	British Columbia		Alberta		Saskatchewan		Manitoba		Ontario		Quebec	
	Average	1946	Average	1946	Average	1946	Average	1946	Average	1946	Average	1946
Fires—												
Total number	1,686	1,707	349	275	256	97	373	392	1,220	1,739	1,033	992
Caused by lightning..... %	36	30	3	4	6	0	9	7	21	17	7	6
Area burned—												
Merchantable timber....acres	49,281	18,701	176,047	34,220	60,968	3,950	41,215	9,052	125,799	20,746	84,692	9,529
Young growth.......... "	60,567	33,045	212,599	50,387	246,075	5,856	34,600	31,510	55,092	21,169	19,447	5.380
Cut-over lands.......... "	117,211	57,120	18,577	7,945	19,941	897	4,071	4,029	32,216	10,407	143,106	23,477
Non-forested lands...... "	117,200	194,529	276,499	179,731	192,140	53,249	157,672	85,174	69,755	24,447	20,185	17,378
Total area burned..... "	344,259	303,395	683,722	272,283	519,124	63,952	237,558	129,765	282,862	76,769	267,430	55,764
Damages.................. $	869,323	306,265	1,099,584	247,733	227,653	20,258	151,301	68,631	753,084	381,480	934,586	278,730
Cost of fire-fighting......... $	259,061	156,451	91,638	49,216	71,219	12,805	29,746	34,495	219,716	294,769	184,049	153,778
Total damage and fire-fighting cost........ $	1,128,384	462,716	1,191,222	296,949	298,872	33,063	181,047	103,126	972,800	676,249	1,118,635	432,508

—	New Brunswick		Nova Scotia		DOMINION LANDS							
					National Parks		Indian Lands		For Expt. Stations		Yukon	North-west Territories
	Average	1946	Average	1946	Average	1946	Average	1946	Average	1946	1946	1946
Fires—												
Total number	216	284	253	309	64	49	58	53	5	6	16	58
Caused by lightning..... %	7	5	1	1	14	33	10	4	0	17	0	5
Area burned—												
Merchantable timber.... acres	4,003	5,924	1,111	3,287	6,432	232	3,502	3,837	405	....	10,513	285,883
Young growth.......... "	2,853	16,486	4,754	1,701	20,897	41	2,504	24,925	671	414	....	24,880
Cut-over lands.......... "	16,537	16,594	1,026	7,582	4,262	348	661	91	42	101	3,860	20
Non-forested lands...... "	2,722	4,179	4,141	7,521	10,271	1,156	7,287	19,957	354	402	6,887	1,141,704
Total area burned..... "	26,115	43,183	11,032	20,091	41,862	1,777	13,954	48,810	1,472	917	21,260	1,452,487
Damage.................. $	183,580	426,900	22,246	78,185	59,427	1,362	12,884	14,968	5,375	200	50,442	226,727
Cost of fire-fighting......... $	22,770	133,206	15,324	48,000	15,768	3,958	5,108	11,222	504	40	2,075	5,584
Total damage and fire-fighting cost........ $	206,350	560,106	37,570	126,185	75,195	5,320	17,992	26,190	5,879	240	52,517	232,311

TABLE IV

Fire season 1946—Comparative statement by regions

Region	Increase or Decrease in Relation to Average for Period 1936-45			Proceedings Under Fire Laws		Deaths
	Number of Fires	Area Burned, Acres	Fire-fighting Cost Plus Damage	Prosecutions	Convictions	
			$			
British Columbia	+ 21	− 40,864	− 665,668	39	37	0
Alberta	− 74	− 411,439	− 894,273	51	47	0
Saskatchewan	− 159	− 455,172	− 265,809	0	0	0
Manitoba	+ 19	− 107,793	− 77,921	5	4	1
Ontario	+ 519	− 206,093	− 296,551	17	14	0
Quebec	− 41	− 211,666	− 686,127	10	10	0
New Brunswick	+ 68	+ 17,068	+ 353,756	58	53	0
Nova Scotia	+ 56	+ 9,059	+ 88,615	12	12	0
Yukon	....	....	....	1	1	0
N.W. Territories	....	....	....	4	4	0
Other Dominion Lands	− 19	− 5,784	− 67,316	0	0	0
Canada	+ 390	−1,412,684	−2,511,294	197	182	1

FOREST PRODUCTS LABORATORIES

The year 1946 saw the resumption by the Forest Products Laboratories of their peace-time functions after a long period during which their staff and facilities were largely engaged on special war problems. Activities continued to be closely associated with industrial problems which arose in the wood-using industries; there was an exceedingly heavy demand for timber for housing and for rehabilitation of public utilities, to which only limited attention could be devoted in war years; there was also a very keen demand for pulp and paper products of all kinds. In such matters the assistance and advice of the Laboratories were in demand, in many cases to such an extent as to impede progress on important research projects.

A notable feature was the great amount of attention which members of the staff were called on to devote to scientific and technical committees set up to promote industrial standards, to consider new fields of research, and to apply to peace-time problems the experiences of war-time research, where such application seemed practicable. Much time was also spent in planning new research projects. The launching of some of these had to be delayed because of difficulty in obtaining qualified personnel, so greatly in demand in industry.

Another important feature in the industrial utilization of timber resources in the past year was the keen interest shown by industry in the better use of raw materials. This was manifested in the many inquiries from industry regarding wood waste and other industrial by-products, the use of species of timber to which previously little attention has been given, and the grouping and planning of industry so as to eliminate as far as practicable wasteful methods of utilization of raw wood. This interest has developed on account of (1) increasingly high costs of raw materials (2) the cutting out of more readily accessible timber supplies, and (3) keen demand for all types of forest products.

The following is a brief description of a few of the more important activities in the Laboratories during the year.

MAIN LABORATORIES—OTTAWA

DIVISION OF TIMBER MECHANICS

An investigation of the strength of prefabricated wall panels of plywood glued to a framework was undertaken to determine the strength factors to govern the construction of such panels for use in domestic housing. Several types of panels were tested, and the results indicated their suitability as building units capable of being prefabricated for domestic housing. A tentative specification for glued prefabricated construction for inclusion in building codes was prepared in conjunction with the Central Mortgage and Housing Corporation.

During the war, permissible building stresses for structural timber were increased in the United States by 20 per cent, in view of the shortage of materials. Considerable interest has since been taken in making this a permanent measure in Canada and the United States. Accordingly, during the year, data from tests made by the Laboratories on structural timbers were re-analysed to determine to what extent an adjusment in safe allowable working stresses is justifiable.

Strength values for yard lumber were examined to provide data for the design of buildings for which structural grades of lumber are not available. Tables of permissible spans for beams made from lumber graded in accordance with the practices of various lumber associations were prepared for inclusion in a proposed building code for smaller municipalities.

A scale model of a 45-foot span beam designed for use in a new building was constructed with laminated flanges and plywood webs. Under test, this beam withstood stresses over five times the design stress before failure occurred. indicating that adequate safety factors had been incorporated in the design.

The effect of prolonged high temperatures upon the strength of casein and urea-formaldehyde glued joints was studied to determine the durability of these joints when exposed to conditions similar to those found in exterior construction. Experiments on the use of infra-red lamps for producing rapid initial set in urea-formaldehyde glues showed that this use of infra-red heat could be satisfactorily applied to certain types of laminated construction.

Materials for extending the coverage of resin glues were investigated to obtain the most suitable extender of domestic origin. Present experiments indicate that rice hulls and cedar bark powder have some value for this purpose and may serve within limits as substitutes for the more expensive starch, or for extenders now imported from abroad.

The investigation of the practicability of bonding hardwood veneers to low-cost softwood backing for use as flooring strips and as flooring panels was continued. A test floor made of different types of this hardwood veneer flooring, including some of sufficient thickness to obviate the need for sub-floors, has been installed at the Laboratories. This floor has been in service for 16 months and no deterioration has been observed.

The collection of data on the strength properties of Canadian woods was continued, two shipments of Eastern hemlock and one of red pine being obtained for testing. The investigation of the relative strength of rock elm and white elm was also continued to determine whether the inclusion of white elm of high density in commercial shipments of rock elm is justifiable.

The results of a study of the effect of red-stain and pocket-rot upon the strength of jack pine poles indicate that staining resulting from early stages of *Fomes pini* infection does not decrease the load-carrying ability of the poles. In the later stages of *Fomes pini* infections, where pockets of rot have developed, there is little reduction of strength of the poles in the cases where rot is segregated around the longitudinal axis of the pole and does not exceed twenty per cent of the cross-section area.

Assistance was given to manufacturers in connection with container design and in improving the packaging of their products; also to the Department of Agriculture in the preparation of specifications for poultry boxes. Some testing of containers for specific commodities was also undertaken to determine their suitability for domestic and export transportation. A report on packaging for export was prepared.

The Laboratories were active on Committees of the American Society for Testing Materials set up to deal with container specifications. A good deal of assistance was also given in the organizing of the Committee on Protective Packing, which has been set up under the Canadian Standards Association.

DIVISION OF WOOD PRESERVATION

The creosote treatment of poplar ties was studied. This is part of an investigation which has as its objective the increased utilization of the so-called inferior species for railway cross-ties in order to reduce the drain on the stands of recognized tie species, such as jack pine, Douglas fir, and the heavier hardwoods.

Steeping in solutions of copper sulphate is a cheap process for the treatment of fence posts and is extensively used in portions of the Western Provinces with low rainwall. Tests were made on five different species of woods grown and treated at the Forest Nursery Station, Indian Head, Saskatchewan.

Service tests of full-size timber products are still required to obtain the final answer as to the effectiveness of a wood preservative. Such tests, however, take from 20 to 30 years, and considerable time was spent in developing and improving methods for accelerated laboratory testing of preservatives so that some information on new preservatives may be obtained in a shorter time. Accelerated laboratory tests were made and service tests set up to determine the effectiveness as wood preservatives of pentachlorophenol and copper naphthenate, which were used extensively during the war and are now used to relieve the present shortage of other preservatives such as creosote. A report was prepared.

Wood tar creosote produced in Western Canada was tested to determine its suitability for use as a wood preservative. Old and new cedar poles treated by those methods while in use were examined after six years' service to determine the penetration of the preservatives and the effectiveness of the treatments in preventing decay at the critical point, the ground-line. This work is supported by member companies of the Canadian Electrical Association.

To assist engineers and others interested in computing the annual charge of timber structures, work was continued on recording the life of treated and untreated timbers in service. Tests recorded number 981, of which 747 were active and 234 have been concluded. These include such items as cross-ties, telephone poles, piling, posts, caps stringers, sheathing, and wharf decking.

DIVISION OF WOOD CHEMISTRY

Experiments on the hydrolysis of wood for the production of sugars were carried out in a small pilot plant which has a capacity of about 20 to 25 pounds of wood per run. These experiments, based on the Scholler process, are being undertaken with a view to increasing yields and developing new hydrolysis techniques. It was found that the yields of reducing sugars obtained from the hydrolysis of Douglas fir chips varied from 35 to 49 per cent, depending on the modifications employed, the highest yields being obtained when there was no rest or steaming period between cycles. In runs made on white pine and black spruce, the yields of reducing sugars obtained by the most efficient modification tested were lower, being 45 per cent and 37 per cent respectively. A report has been prepared and experimental work is continuing.

Work on the chemical composition of Western red cedar bark has been completed and a final report published. In this study, the inner and outer bark fractions were analyzed by the methods usually applied to wood. With the exception of a higher lignin and higher one per cent sodium hydroxide-soluble content in outer bark, the two fractions show similar compositions. Pentosans are present to the extent of about 10 per cent. Pulp, which was obtained in a yield of 33·6 per cent, contains about 74 per cent glucose, 8·9 per cent xylose, and a trace of mannose.

A preliminary investigation was carried out on the preparation of structural boards from Western red cedar bark. The method used consisted of chipping the bark, steaming the chips for a short time with low-pressure steam, and disintegrating them in a laboratory beater. The pulp obtained was formed into thick mats in a sheet-forming machine and the mats were subjected to 400 p.s.i. pressure at a temperature of 190°C. until a hardboard was formed. As the water absorption of these boards was high, tests were carried out on boards prepared in the same manner but with the addition of a small amount of rosin size. The addition of this size greatly reduced the water absorption. Work with various types of size is in progress.

Experiments were continued on the production of structural boards from sawdust. The materials used to bond the sawdust were blood, castor pomace, drip oil (a waste oil from the production of water gas), urea-formaldehyde resins, and sulphite waste liquor in combination with oxalic acid. Some of these boards show tensile strength values comparable with those of commercial boards. Work is continuing.

In another series of experiments, sawdust was treated in various types of mills such as a hammer mill, a ball mill, and a burr mill. Sawdust ground in a burr mill without previous treatment was suitable as an extender for groundwood pulp for fibreboard and may have possibilities as a substitute for inorganic fillers such as talc, clay, and kieselguhr. A report has been written describing the properties of sheets obtained from mixtures of commercial groundwood pulp and the material obtained by treating sawdust in a burr mill.

Valuable products can be derived from the reduction of lignin with hydrogen gas under high pressure in the presence of catalysts. Experiments on the reduction of lignin in solution by electro-chemical treatment might also yield valuable products. Accordingly the electrolysis of sulphite waste liquor in a diaphragm cell was studied. The first series of experiments was carried out with ordinary sulphite waste liquor obtained from a local mill. This material contains approximately 2 per cent sugars which might be transformed into various products during electrolysis. In order to simplify conditions, waste liquor, which had been fermented and distilled for the production of ethyl alcohol, was used for the latest experiments.

Methoxyl determinations were carried out on the dry residues from untreated waste liquor, on the dry residues from treated liquors taken from anode and cathode compartments, and on deposits formed on the cathode. Considerable changes in methoxyl content were found, indicating that the electrolysis has a marked effect on the lignin. Further analytical work is under way.

DIVISION OF WOOD UTILIZATION

This Division, which was inactive during the latter part of the war, was reorganized early in the year and a long-term program was developed. This program comprises a series of investigations having as their objectives the reduction of waste and improvement in utilization in the lumber manufacturing and wood-using industries.

Detailed plans were prepared and, with the co-operation of the Canadian Lumbermen's Association, arrangements completed for a study of sawmill waste and its utilization at thirty-one softwood sawmills in Ontario and Quebec. Of the mills selected, twenty-seven are cutting spruce and four are cutting pine. This will provide comprehensive data for the spruce mills of this region and enable a start to be made on the collection of similar data for the pine mills. A satisfactory study procedure was developed, based on somewhat similar investigations carried out at sawmills in the Maritime Provinces in 1939.

Plans were prepared and preliminary arrangements made for a series of investigations on the relationship of diameter to efficient log utilization, to be carried out concurrently with the study of sawmill waste at sawmills in Ontario and Quebec.

An investigation was carried out, in co-operation with the Fuel Research Laboratory, on the feasibility of so modifying the fire-box of the type of steam boiler used in portable and small stationary-type sawmills that sawdust could be used for fuel instead of the slabwood now used. A more widespread utilization of sawdust for boiler fuel at these small mills would enable large quantities of slabwood mill-waste now used for this purpose to be sold for domestic fuel, or as pulp chips, where the sawmill is suitably located. Details of a suitable type of Dutch oven attachment for the fire-box were worked out and a report is being prepared with a view to publication.

Preliminary to more intensive work in the future, a short survey of the secondary wood-using industries in Quebec and Ontario was undertaken as a means of gaining general information on the type and character of problems being encountered.

Short articles on nine commercial woods of Eastern Canada were prepared for the Department of Trade and Commerce. These articles are intended for trade promotion work overseas, particularly in the United Kingdom.

Miscellaneous matters dealt with during the year had reference to the manufacture of wood flour, hardwood flooring, matches, excelsior, toothpicks, shoe heels, barrel bungs, handles, furniture, and coffins. Information was also supplied regarding possible uses for sawdust, shavings, trimming waste, and waste veneer.

DIVISION OF LUMBER SEASONING

The extension of the activities of this Division and the resumption of active project work have been handicapped by lack of staff. Technical service to the wood-using industries continued as an important part of the work. This service included the supplying of information on the prevention of certain defects during kiln-drying, modifications of kilns and kiln equipment in order to increase the output of seasoned lumber, volume of steam required for kiln-drying various sizes, drying schedules for different species and sizes, conditioning treatments to remove or reduce certain kiln defects, and moisture content specifications and tests.

A survey of manufacturing firms in some of the secondary wood-using industries of Ontario and Quebec was made in order to obtain information on seasoning practices and problems. The firms visited were representative of different phases of woodworking, such as the manufacture of musical instruments, coffins, furniture, sporting goods, farm equipment, plywood, barrels, and baskets. The seasoning and storage problems encountered during this survey were noted in connection with the long-term program of seasoning projects to be investigated.

A special investigation was carried out to determine whether it would be possible to straighten crooked 2" x 4" spruce. Most of the material tested, cut from small logs, contained box heart and knots. Although the lumber was comparatively straight after it had been subjected to steaming for an extended period, little improvement was noted after it had been re-dried.

Charges of 12/4-inch white pine and beech were dried to check the efficiency of existing drying schedules and for comparison with similar material that had been dried by high-frequency electric heating. The experimental kilns were also used for drying special charges of lumber for use by government organizations.

DIVISION OF TIMBER PATHOLOGY

Laboratory tests on the relative decay-resistance of rock elm and white elm were continued. This investigation is to determine whether dense white elm would prove a satisfactory substitute for rock elm, the supply of which is insufficient to meet the demand. The wood of both species showed a wide range of variation in resistance to decay, and no correlation was found between the specific gravity and decay-resistance in either species. The position of the wood in the tree was also unrelated to the degree of fungal attack. Further tests on the rock elm are necessary before definite conclusions can be drawn.

Fungi isolated from green elm and from green jack pine were studied in agar plate cultures. Fungi of each group were grown in association, their effect on one another was observed, and photographic records were made. In addition, the fungi isolated from jack pine were grown on wood blocks and the rot development and discolorations noted.

A study of fungi present in lumber seasoning yards has been made by means of spore traps placed in two yards. More than 1,300 cultures of the fungi obtained from these traps were examined microscopically and the potential wood-rotting, wood-moulding, and wood-staining fungi separated into three groups. Cultures of the wood-rotting type were paired in the hope of obtaining diploid mycelia. Five wood-rotting species and several wood-staining and moulding fungi were identified.

Fungi causing blue-stain and a brown surface disfiguration on rough white pine lumber were studied. The brown discoloration was found to be due to the development of brown conediphores of a fungus which penetrated the wood without staining it. This fungus was very tolerant of a proprietary "sap-stain" chemical treatment used at the mill from which the samples were submitted. However, *Cadophora fastigiata,* which caused the blue-stain, was inhibited to a marked degree.

Cultures and specimens which included defects in birch, maple, oak, poplar, hemlock, spruce, and white pine were added to the reference collection.

Examinations were made of wood specimens, containing defects, which were submitted by inquirers from time to time. These inquiries had reference to rot in boats, building timbers, wood pipes, storage bins, and churns, the identification and causes of rot and discolorations in various species of furniture wood, and the control of moulds and stain in fruit baskets and spoolwood.

DIVISION OF TIMBER PHYSICS

Considerable time was devoted to an investigation of the chemical treatment of trees to facilitate the removal of bark. In testing spruce and aspen poplar of pulpwood size and cedar of suitable size for posts and poles, it was found that material from trees treated in spring or early summer with suitable chemicals could be felled in late autumn and peeled cleanly with greater ease than by the usual "sap-peeling" methods in which no chemical treatment is used and which cannot be successfully employed much later than the first week of August. In view of the decreased weight noted in logs of treated trees allowed to stand for a year after treatment, amounting to some 5 to 10 pounds per cubic foot, the process should be of importance in reducing shipping costs and in improving the buoyancy of river-driven pulpwood.

Reports of the work to date were published and discussed at the annual meeting of the Canadian Pulp and Paper Association, Woodlands Section. Arrangements have been made for a large scale co-operative investigation on a commercial pulpwood operation to observe the effect of chemical treatment on the barking and weight reduction of three softwood and three hardwood species.

Specimens of wood that had failed in service for unexplained reasons under relatively light loads were examined in an effort to determine the cause of failure. Detailed microscopic examinations were made. In some cases it was found that the presence of microscopic fractures in the cell walls was the cause of the brashness. A report was prepared on methods of inspection by which such material might be detected. Further work is in hand to determine the frequency with which this defect occurs and the kinds of wood in which it is prevalent.

Measurements of basic density were made on samples of five species grown at the Dominion Forest Nursery Station, Indian Head, Saskatchewan. The fuel value of the various species was determined on the basis of their relative densities, and a report prepared.

Additions were made to the reference collection of important timbers of the world. This collection is maintained for use in identifying specimens of Canadian and foreign woods submitted for species identification and as an aid in assessing the qualities of foreign woods with which Canadian woods may compete in world markets.

Other work included the cause of wear on cutting tools in the machining of plywood, the weight and volume of bark on pulpwood bolts of various Canadian species, the variation in properties within a species, and the effect of such variation on commercial uses.

RADIO FREQUENCY HEATING

A program of research on radio frequency heating has been initiated by the Laboratories to study its application to the wood-working industry and to meet the demand for information on this subject. A tour of American factories was made to determine to what extent radio frequency was being applied industrially. It was found that, while radio frequency heating gives promise of a wide variety of applications, much research is required before its ultimate value can be realized. During the past year, the Laboratories were active in developing improvements in the technique of current industrial applications; at the same time, exploratory work was done towards finding new uses for radio frequency heating.

Several moulding forms for bonding curved plywood were constructed to study the practical problems of electrode and pressure system design. The plywood sections produced demonstrated the scope of plywood products which could be mass-produced by means of radio frequency heating.

In recent years, the shortage of large structural timbers has stimulated a growing interest in heavy laminated construction. However, the problem of providing heat to cure the glue lines has impeded more general adoption of this form of construction. The application of radio frequency heating to the seasoning of thick lumber was studied by means of experimental 12/4-inch pine and beech. Radio frequency heating shows promise as an expeditious method of drying high-value material for special uses. This work is continuing.

A procedure for measuring the dielectric properties of woods and glues was developed to meet the need for these data which has resulted from the industrial use of radio frequency heating for bonding and drying of wood.

Exploratory investigations were carried out on other applications of radio frequency heating, including the drying of impregnated wood, the drying of pulp products, the edge-gluing of lumber and veneers, and the assembly gluing of prefabricated house panels.

PUBLICATIONS

Circular 62—Chemical Composition of Western Red Cedar Bark.

Mimeograph—

110—Fire-retardant treatment of structural timbers.
113—Strength properties of glued laminated beams.
114—Improved wood, brief review of various developments.
115—Effect of exposure on strength of Douglas fir cross-arms.
116—Effect of chemical treatment on the ease of peeling bark from trees felled in November, 1946.
118—Effect of season of cutting on durability of jack pine saplings.
119—A summary of experiments on chemical barking of trees.
120—Effect of high temperatures on casein and cold-setting urea-formaldehyde glues in close contact joints.
121—Tension normal to glue line plywood tests (Revision).
124—Ethyl alcohol from wood—(Reissue).
125—Packing for export.

Papers prepared for presentation at the British Empire Forestry Conference

Conservation by better utilization.
Forest products research in Canada.

In addition to the above, several articles were prepared by members of the staff for publication in various trade and technical journals.

VANCOUVER LABORATORY

The Vancouver Laboratory provides regional facilities for service to the lumber and wood utilization industries of British Columbia. For the past 29 years, this Pacific Coast research unit has been associated with the University of British Columbia. Post-war planning in all phases of forest products utilization has shown the necessity for an expansion of staff and facilities. During the year, additional temporary accommodation was obtained and plans were made for an increase in the number of divisions, effective in the new year.

DIVISION OF TIMBER MECHANICS

Standard tests on small, clear specimens were completed on one shipment of mountain hemlock (*Tsuga Mertensiana, Bong.*, a species occurring in the higher mountain areas of the southern coastal region) and one of Amabilis fir from the lower coastal area.

Many standard mechanical and physical tests were made to meet the demand of the British Columbia woodworking industry for information on the comparative properties of secondary British Columbia species and of woods imported for local use. Arrangements were made for shipments of second-growth Douglas fir which will be used in determining basic properties of this material, the demand for which is increasing.

An analysis was completed of the results of tests made on Douglas fir and Western hemlock structural timbers, comparing the effect of grading these timbers under the Domestic and the Export Grading Rules of the British

Columbia Lumber Manufacturers' Association, the Canadian Standards Association Specifications for Structural Timbers, and the No. 12 Standard Grading and Dressing Rules of the West Coast Lumbermen's Association. This analysis is being made in connection with the review of allowable building stresses for structural timbers that is being undertaken in co-operation with the United States Forest Products Laboratories.

Testing was completed and a final report prepared for publication on a study to determine the effect of kiln-drying upon the strength of Western hemlock of aircraft quality and to establish satisfactory drying schedules which would not damage the mechanical properties of this wood when used for this exacting purpose.

The strength of new and improved adhesives and the merits of new techniques of applying these adhesives were determined for the guidance of manufacturers and wood-using plants. Doors with pieced, glued stiles and single-sheet plywood faces were tested in diagonal compression and showed practically the same resistance to distortion as similar doors with one-piece stiles.

An analysis was made of strength data obtained from standard tests of small clear specimens of Douglas fir and Western red cedar, to determine the comparative specific gravity and the mechanical strength properties of material cut from the north, east, south, and west sides of the tree. There was no apparent difference in the strength functions which might be attributed to position in the tree.

Committee work for the Canadian Standards Association was commenced on the preparation of a standard specification covering Douglas fir poles. A working plan was prepared for an investigation of the taper in Douglas fir and Western red cedar poles and piling.

Some study was given to the problem of using creosote-treated Western hemlock wood-stave pipe as a substitute for Douglas fir pipe in large diameters up to 10 feet, for certain specialized supply lines, and also to means for preparing and testing sections of the larger diameters, using the sand-box loading method.

DIVISION OF TIMBER PRODUCTS

A study was carried out under laboratory conditions, in co-operation with the British Columbia Research Council and the British Columbia Forest Service, in an effort to determine the effect of various humidities at night temperature on the inflammability of forest floor litter, as indicated by fire-indicator sticks. Groups of hazard sticks were dried to equilibrium moisture content with a range of relative humidities at 50°F. and were tested at 9 per cent and 6 per cent initial moisture content. In neither case was the absorption in eight hours sufficiently rapid to indicate much change in the fire-hazard conditions, even when comparatively high relative humidities were maintained. The preparation of Douglas fir indicator sticks for use by the British Columbia Forest Service during the 1947 fire season was continued.

The comparative moisture pick-up during storage of air-seasoned and kiln-dried Western red alder furniture stock was studied. Results showed that the equilibrium moisture content of the kiln-dried materials in storage was from 3½ to 5 per cent lower than for similar air-dried material.

Special seasoning problems receiving attention included the kiln-drying of broom handle stock made from Western hemlock mill waste, the kiln-drying of black cottonwood for use as core stock, and the development of a substitute for a steam-heated dry-kiln for use by small mills where a continuous supply of steam is not available.

A survey was made at a number of coast sawmills of average production capacity to determine what changes had occurred since 1931 in the volume of sawmill waste produced and utilized. The indications pointed to a higher volume of waste than in the 1931 studies which covered, in detail, the volume of mill waste produced and its utilization for a representative number of British Columbia mills. It was found, however, that practically all the mill waste was being used for fuel, the amount going into the mill burners being negligible.

Floor tiles made with a sawdust filler and a magnesium-compound binder were tested, and a number of improvements suggested. The resultant product showed a hardness comparable to that of certain asphalt tiles and of Douglas fir flooring.

An investigation was undertaken in co-operation with the British Columbia Research Council in an effort to find some means of rapid preliminary drying of Western hemlock sawdust, in order to improve its calorific value. The use of infra-red drying was not satisfactory, owing to the opaqueness of the material, while tests using pressure only, by passing the sawdust under rollers, gave no conclusive results but indicated that only a small part of the moisture was expelled.

A mill study, carried out to determine the relation of production costs to the selling price for Engelmann spruce logs of different grades and diameters, showed little difference in the value per M. ft.b.m. for logs of different sizes within the log grade; however, the sawing time per thousand feet increased rapidly for small logs, so that the net recovery per thousand is largely a function of the sawing time. A similar study of the recovery of solid wood from cull logs, made at a northern coast sawmill, indicated that the scaler's estimates of the volume of solid wood in such logs are low on the average. The percentage of sound wood recovery showed no relation to the log diameter and the indicated sawing time per cubic foot of sound wood for all cull logs was approximately four times that for sound logs.

Studies were made to determine the lumber recovery value of Douglas fir logs of various sizes and grades as cut per 8-hour shift by sawmills of medium to average capacity, and to compare the cost of operating gang and circular sawmills. An interesting result of the study was the considerable increase in the sum of the scale of two or more short logs bucked from long logs before sawing.

The extent to which fluorescence in wood-destroying fungi occurring in Sitka spruce could be used for determining the presence of incipient decay in lumber was studied, using ultra-violet light. The results indicated that this was not a satisfactory method of detection as the fluorescence was observed only on those areas where decay was sufficiently advanced to be detected by visual inspection.

An investigation of the toxicity to certain wood-destroying fungi of a copper naphthenate wood preservative was undertaken, this substance having been suggested as a substitute for creosote where a highly efficient or expensive preservative is not required. Preliminary tests, using agar plates and exposed, impregnated wood blocks, show a toxic point between ·360 and ·320 per cent of copper naphthenate.

The collection of service data on the durability of wood under British Columbia Coast conditions was continued by means of site inspection of many wood installations, both preservative-treated and untreated.

Other pathological problems receiving attention included the prevention of stain and decay during storage of large, green hemlock cants; the determination of means of arresting decay in red cedar Indian totem poles; the prevention of deterioration in sap lumber when shipped to Australia in deckloads; the finding of the relation of wood density to the pathological condition of wood; and the development of methods for improving penetration of preservatives in refractory hemlock.

Serious plaster staining over Western red cedar lath in coastal areas was the subject of preliminary investigation, and possible means for partial sealing of the lath were considered.

Assistance was extended to the British Columbia Research Council in a survey of the manufacture of cascara extract, from both the wood and the bark.

PUBLICITY

Articles dealing with certain specific problems under investigation at the Laboratories were prepared by members of the staff for publication in trade and technical journals.

PULP AND PAPER RESEARCH INSTITUTE OF CANADA
MONTREAL

The Montreal Laboratory of the Forest Products Laboratories is a part of the Pulp and Paper Research Institute of Canada, which is supported jointly by the Dominion Government, the Canadian Pulp and Paper Association, and McGill University. The work of the Institute is under the supervision of a General Director who is responsible to a Joint Administrative Committee representing the three constituent bodies.

FUNDAMENTAL RESEARCH STUDIES

Following the development of a method of preparing lignin from solvent-extracted spruce wood by dissolving the carbohydrate constituents with specially prepared aqueous periodic acid, the resulting "periodate" lignin, when pulped under standard conditions with sulphite liquor, acted in a manner practically identical with that of lignin in spruce wood flour. It also pulped normally by the soda process, and reacted similarly to almost all other isolated lignins when subjected to other tests. Hence it should prove most useful for pulping studies in which it is desirable to avoid the complicating effects of holocellulose constituents.

The extraction of wood by liquid ammonia under high pressure is being studied as a method of isolating as much lignin as possible with the minimum chemical change. This is also the object of the work with periodic acid.

An attempt was made to ascertain if the expensive periodate or the lead tetra-acetate methods of oxidizing glycol groups in carbohydrate hydrolysates, sugar alcohols, and cyclohexane diols could be replaced by a cheaper electrolytic method. Some preliminary success has been achieved in oxidizing ethylene glycol to formaldehyde.

A successful method was finally devised for esterifying a hydroxyethyl cellulose with paratoluene sulphonate, and an analysis of the series of tosyl esters obtained by this method is being made in connection with the study of the distribution of hydroxyethyl units in a hydroxyethyl cellulose.

A study of the chemical nature of bark was begun. A quantity of white spruce bark was subjected to extraction with methanol, which was then evaporated. The residue from this, as well as the extracted bark, was subjected to further extraction with certain solvents and the extracted substances are being identified as far as possible.

In the general investigation of lignin, several studies are being made on the oxidation of less complicated analogues of lignin such as vanillin, parahydroxybenzaldehyde, and pyrogallol. Oxidation studies are also being made on starch and cellulose to ascertain the exact mode of attack on the glucose units.

APPLIED RESEARCH STUDIES

Much of the work on printing studies during the past year was devoted to an investigation of the penetration of oil into paper. Measurements were made of the void fraction available for oil penetration. Measurements of the penetration of paper by oil, air, and carbon tetrachloride were made for the purpose of studying the structure of the sheet. Further work on a new smoothness tester showed the reproducibility of the test to be good, but revealed the necessity for providing some means of approximating the effect of the ink film in printing. The instrumental equipment was improved and the work facilitated by the use of a galvanometer of more modern design.

The detailed examination of methods of analysing sulphite waste liquor was continued. These studies are for the purpose of distinguishing between the various compounds in the liquor when methods of utilizing it are developed. Some success was achieved in finding a method which would give a proper characterization of the concentration of the so-called free sulphur dioxide. It was also found possible to separate the ligno-sulphonic acid group of components from the carbohydrate group by fractionation. This facilitates the study of these materials. A direct method for the determination of the sulphonic acid group which involves conductometric titration is now available for the first time.

In the study of alkaline pulping, means were found for enabling mill conditions to be duplicated with the small experimental digester and auxiliary equipment being used. Work was carried out to determine the effect of varying the maximum temperature, the time at maximum temperature, the alkali charge, and the sulphidity. Bombs heated in an oil bath were used to determine the rate of delignification for various cooking times, temperatures, and liquor strengths.

Changes were made in the miniature grinder to enable measurements to be made with the stone rotating in either direction. A study of the grinding conditions and the pulp characteristics with the stone running for some time in the normal direction and then in the reverse direction showed that grinding produces a marked unidirectional conditioning of the stone. The investigation of the "longitudinal" grinding of wood, where the fibres are parallel to the movement of the stone, was continued. Sitka spruce was used because pieces of wood with growth rings of small curvature could be obtained from it for longitudinal grinding. Comparison of these results with those obtained with the conventional "transverse" grinding showed that, at the same grinding pressure, the power requirement was much greater and production and freeness were much less with the former, while certain strength tests showed higher results. Better longitudinal grinding was done on an unconditioned stone.

Work on the measurement of the surface area of a pulp was interrupted for a time, but a related study was made of the variation in the concentration of wet pulp with the pressure to which it is subjected. This is of importance in studying the packing of a pulp on a screening medium.

Some time was spent in studying means of improving the tests for determining the freeness of pulp and the bursting strength of paper.

The study of the efficiency of present methods of driving pulpwood in rivers was completed and published in book form. This was supplemented by the preparation of a practical guide for long-term systematic planning of river improvements and water regulation for driving, on the basis of complete drainage areas.

A detailed study was made of the regeneration of spruce to determine the favourable and the unfavourable factors so that silviculturally desirable cutting practices may be adopted.

The feeding of woods workers was investigated to ascertain what improvements could be effected in the interests of their health and of sound economy. Much valuable information was obtained regarding proper choice of foodstuffs, preparation of a balanced diet, waste elimination, proper eating practices, and other aspects of feeding.

An investigation was made to determine practical procedures for studies of the rates of forest growth to permit more accurate planning for future wood supply.

The conveying of wood by gravity down a rough steep slope by means of a suspended wire was studied to ascertain if it was better than the conventional technique.

A compilation and analysis were made of available data on the design and construction of permanent and portable logging camps, including a survey of various suitable building materials.

SERVICES

The usual service was rendered in testing samples of pulp and paper and in checking instruments for making such tests. Information was provided in response to questions on pulp and paper technology.

Articles on various aspects of the work under way were contributed to a number of technical journals.